MAY 1971

Key-tape and disk systems speed data input

COM-indexing: getting out what went in

IFIP '71: a meeting of East and West

Computer Decisions

A HAYDEN PUBLICATION INFORMATION SYSTEMS AUTOMATED PROCESSING PROBLEM SOLVING

The route to halftone image synthesis

T H NELSON PRES
NELSON SYSTEMS CONSULTANT
BOX 3
SCHOOLEYS MOUNTAIN NJ 07870

Too many times, intelligent, rational companies lose their shirts in their computers.

They buy a logic system to help save them money. But by the time they finally get the system installed, they find they don't have any money to save.

Well, if it's any help to you, we can save you a few bucks on your memory system. Or to put it more precisely, a few thousand bucks on your next direct access storage facility.

With our new Bryant 2200.

It's plug to plug compatible with the IBM 2314 and 2319. So you can just wheel it right up to your IBM 360—and start thinking.

It comes in the same module configurations as the 2314. A controller and a single drive unit. Or a controller hooked up with from one to four dual drive units, with a single drive unit as a spare.

And if you need service, you get it. In less than two hours.

And it goes, like we said, for peanuts. Thousands of dollars less than the 2314.

If, of course, the 2200's lease price and memory capability are a little more than what you had in mind, we have a smaller model. The 1100, which is identical to the IBM 2311.

It's every bit as good as the 2200. You just don't pay for more memory than you can use.

If you'd like to get a look at our entire peanuts gallery, remember to get a hold of a Bryant representative and ask him to show you our entire line of memory systems. Or write to 850 Ladd Road, Walled Lake, Michigan 48088.

The new Bryant 2200. A fantastic Disc Drive that goes for peanuts.

BRYANT COMPUTER PRODUCTS

THE BIG MEMORY EXPERT.

A UNIT OF

XLO®

EX-CELL-O CORPORATION

INFORMATION RETRIEVAL NUMBER 4

Big things are happening at Honeywell.

Series 6000 Giants are off and running.

The Other Computer Company introduces a full line of large-scale systems: Series 6000. A family of big computers featuring multiprocessing and multiprogramming, extensive data communications, data base management, time-sharing, built-in testing and maintenance, and plenty of growth potential. It's all there; see for yourself.

There are six state-of-the-art models to choose from: Models 6030, 6050, and 6070 handle mixed scientific/engineering and business workloads. Models 6040, 6060, and 6080—with more than 100 powerful new business-oriented instructions—are specifically designed for heavy COBOL users.

The heart of the series is the GECOS operating system. It's been working for years; and it's

Continued on page 2.

What's big...

- ☐ **Series 6000 Giants announced.**
- ☐ **Large-scale benefits from GECOS.**
- ☐ **Vast new offerings in small-to-medium systems.**
- ☐ **EDINET education services.**
- ☐ **Data communications in DOD.**
- ☐ **More time-sharing with new 1640 Series.**
- ☐ **Far-reaching data communications systems.**
- ☐ **Keyplex moves mountains of data.**

been steadily refined to meet taxing workloads. It's ready now for your present multidimensional processing needs.

Ten giant steps for the Series 6000.

1. Multidimensional Processing. Series 6000 supports local and remote batch processing, remote access and transaction processing, and time-sharing—all at the same time. All processing modes can access a common data base. Priorities can be assigned dynamically to any processing dimension; for example, you can reassign job queue priorities for specific job types, remote job entry, time-sharing, transactions, etc.

2. Multiprocessing/Multiprogramming. For expanded processing or back-up, Series 6000 systems can add multiple processors. In fact, users can tailor their systems to specific needs by adding processors, memory, Input/Output Multiplexors (IOM), communications processors, or peripherals. For multiprogramming, dynamic memory petitioning offers multiple job activity with low memory overhead. The result is modularity and flexibility for increased throughput and efficiency.

3. Business/Scientific Processing. Hardware and programming language features prepare Series 6000 systems for all manner of mixed business and scientific processing chores. Series 6000 machines are word-oriented with fast internal speeds, floating point hardware, and an advanced Fortran compiler for all types of business/scientific applications. Models 6040, 6060, and 6080 offer an additional instruction set for the business use of a new full-ANSI COBOL compiler.

Here are 12 other management tools for Series 6000:

Generalized Inventory Management System
Generalized Parts Explosion System
Automatic Programmed Tools (APT)
Linear Programming
PERT/Time
PERT/Cost
SIMSCRIPT
Time Series Forecasting
MATHPAC Subroutine Library
Civil Engineering Package
Electrical Utility Package
Biomedical Statistical Package

4. GECOS (General Comprehensive Operating Supervisor). The most advanced, thoroughly proven operating system available. It operates on all Series 6000 models, and its multidimensional capabilities work in all configurations. GECOS provides optimum use of total system resources. It handles automatic scheduling and dynamic resource allocation to ensure the highest possible throughput—in terms of jobs completed per day. And GECOS operates with low overhead. Memory management techniques provide for easy program swapping and complete flexibility in memory allocation. And GECOS has been working for years.

5. Data Base Management. The GECOS Common File System for data base operations includes multilevel tree-structured catalogs,

	6030/6040	6050/6060 (K = 1,024)	6070/6080
Max. Memory Size in words (36-bit word)	128K	256K	256K
Cycle Time (micro seconds per 2 words)	1.2	1.2	.5
No. of Data Channels	16	24	24
Max. Transfer Rate Per IOM (char/sec)	1.3M	3.7M	6.4M
Peripheral Capacity (subsystems)	16	24	24
I/O Compute Simultaneity	16	24	24
Programmable Registers	27	27	27
Floating Point	Yes	Yes	Yes
Memory Protect	Yes	Yes	Yes
Hardware Radix Conversion	Yes	Yes	Yes
Interleaving	No	2-way	2 + 4-way
Instruction Overlapping	No	Yes	Yes
Instructions per second	340,000	550,000	1,400,000
Rental (typical complete system)	$24,100/ $26,000	$44,850/ $46,350	$65,500/ $67,300

Series 6000 offers powerful and modular hardware, complete and demonstrable software, and the right pricing.

password protection, access permissions, and file sharing. So you can access a data base for remote inquiry/response or transaction processing, time-sharing, and remote or local batch processing—all at the same time. The system includes Integrated Data Store (I-D-S), a powerful data base structuring capability using disk storage files. Programs can be processed in sequential, indexed-sequential, or random mode.

6. Front-End Communications Processors. The DATANET communications processors used with Series 6000 are stored-program computers that perform all line control functions and relieve the central system of all communications overhead. Transmission speeds can reach 50,000 characters per second. Teletypewriters, CRT's, and terminals for remote batch entry can be connected. In conjunction with DATANET 355, the Mass-Store-Link feature of GECOS lets the communications processor access mass storage subsystems directly and store all batch input and output, without the attention of the central system.

7. Peripheral Strength. High-speed Input/Output Multiplexors (IOM) can connect a virtually unlimited number of devices while providing high throughput rates and simultaneous operation of all channels. From eight to 24 channels are available per IOM to transfer at peak rates in excess of one million characters per channel. There are new disk pack drive subsystems offering on-line storage up to 2.13 billion characters with average seek times as low as 30 milliseconds. New magnetic tape drives offer speeds up to 266 thousand characters per second at 1600 bits per inch density.

8. High-Up-Time Systems. Series 6000 systems are built from the ground up for a minimum of down-time. With the latest in integrated circuit technology, improved packaging results in more compact and easily maintained hardware. Circuit testers and maintenance panels expedite system diagnosis and help to isolate malfunctions quickly. And, the on-line testing and diagnostic routines in GECOS allow temporary deallocation of central system modules, peripherals, or communication subsystems for automatic checkout while normal processing continues in other system elements.

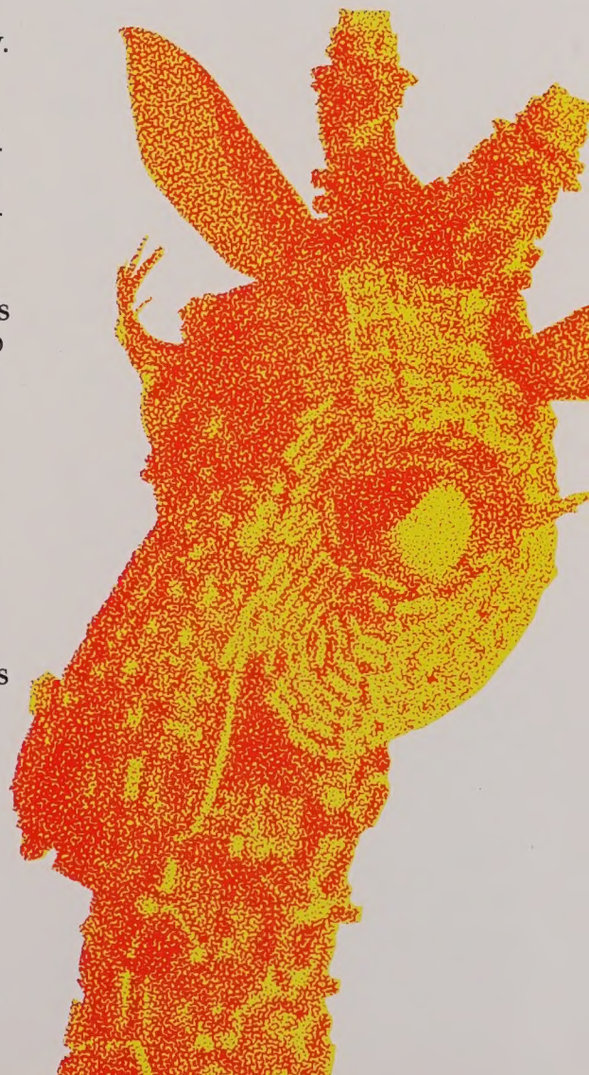
9. Compatibility. Series 6000 grows on you. Add multiple processors, memory, or data communications, and do it without reprogramming or changing operating systems. Hardware modules work together the same way in any Series 6000 configuration. Your programming investment is safe as you work up through Series 6000. Because GECOS is what you start with and what you stay with.

10. Price/Performance. A lot was put into these systems but in a way that lets us price them right. For example, Honeywell feels these six models offer better performance than just about any other comparable systems, and at less money. And Series 6000 comes bundled, so basic support services, education, software, and application packages are included in the basic system price.

Series 6000 systems are a convenient way to upgrade Honeywell Models 400 and 600. But they're just as beneficial an upgrade path for other users. Sure, conversion costs must be weighed, but weigh these benefits, too:

- A sophisticated operating system that is really easy to use.
- Simplified but comprehensive data base management.
- Time-sharing.
- Remote access for MIS or transaction processing.
- Local or remote batch processing.
- Bundled pricing.
- Price/performance.

Check 210 on reader service card.



The large-scale benefits of GECOS.

GECOS maintains the status of all system resources (peripherals, memory, and processors) and all the jobs in a Series 6000 System. And, there is much more to GECOS than basic job scheduling and resource allocation.

Common File System

GECOS has a centralized file system using hierarchical, tree-structured design, accessible by local and remote processing techniques. Catalogs and files are secured by passwords, and file access is controlled by GECOS. Several programs may read a file concurrently, but only one program at a time may update a file. A unique feature of the file system allows maintenance (repacking) routines to clean a portion of the file system while other jobs are accessing other portions.

Batch Processing

Local and remote batch entry can be handled concurrently with remote access and time-sharing. This multidimensional aspect of GECOS means more job throughput, less job turnaround, and better use of system resources. Any batch program that can be entered locally can be entered remotely. Various options are provided to process and route job output.

Remote Access

Data base inquiry, remote data base management, data collection, and other remote access applications round out processing needs. Remote access provides direct terminal access to a program in execution. The program written in any batch language (Fortran, COBOL, etc.) may be submitted via local, remote, or time-sharing batch entry. For remote application, the terminal acts as an input/output peripheral.

Transaction Processing

Everyday business transactions can now be processed in any desired priority with the GECOS Transaction Processing Subsystem. Transactions are entered from a terminal, and the transaction processing executive interprets the transaction code in the message, calls the pertinent application programs, and processes the message. The required output or acknowledgement is returned to the sending station.

Time-Sharing

The GECOS time-sharing executive provides installations with concurrent time-sharing featuring Fortran, BASIC, and a powerful text editing package. A time-sharing batch facility lets users create and initiate batch programs and scan or receive output—all from a time-sharing terminal. The common file system provides catalog structuring, file protection, file sharing, access control, and source/object file storage.

Total On-Line Testing (TOLTS)

The Total On-Line Testing System for GECOS is made up of POLTS, for peripherals; COLTS for communications; MOLTS, for main frame; ROLTS, for remote access processing. These elements are integrated into a system for total maintenance and recovery. Up to eight diagnostic programs may be operating concurrently with user programs under GECOS.

System Resource Monitor

A system resource monitor provides quantitative measurements of system balance and performance. It monitors job flow through the system, status and requirements of all jobs in the job queue, and status of resource allocation tables. Gross imbalances, such as consistently unused memory resulting from a peripheral-bound situation, can be found quickly. Operational inefficiencies and programming bottlenecks can also be identified. Cost/performance advantages of alternatives to existing configurations can also be found from the output.

Data Base Subsystem

GECOS combines its common file system and the Integrated-Data-Store (I-D-S) programming aid to achieve simplified but comprehensive data base management. The design of the common file system ensures that files are accessible in all dimensions, so that files normally maintained on a daily basis may be accessed at any time by a transaction processing program. To complement the centralized file processing concept, I-D-S provides an easy-to-use language and data management technique to integrate differently organized files on disk. The I-D-S language is an extension of COBOL with specific operators for file structuring, storage, and retrieval. Sequential, indexed sequential, or random files can be processed and maintained efficiently.

Communication Mass-Store-Link

To increase the efficiency and availability of remote batch proc-

Vast new offerings in small-to-

Key Specifications:	58	115	115/2	1015	2015
Cycle Time (μs)	1.2	2.75	2.25	1.6	1.33/two char.
Max. Memory (K = 1,024)	10,000	32K	64K	128K	256K
Data Structure	8-bit byte	6-bit char.	6-bit char.	6-bit char.	6-bit char.
I/O Channels	6	2, one opt.	3, one opt.	12, var. speed	12, var. speed
I/O Transfer Rate	350,000 bytes/sec.	500,000 cps.	500,000 cps.	667,000 cps.	1,000,000 cps.
Avg. Disk Seek Time (ms)	75	50	50	30	30
Max. Disk Storage (per control)	4.6M bytes	36.8M char.	147.2M char.	280M char.	1B char.
Magnetic Tape (max. KC)	–	149	149	224	224
Printer (max. lpm)	200	1100	1100	1100	1100
Card Reader (max. lpm)	200	1050	1050	1050	1050
Card Punch (max. lpm)	30	400	400	400	400
Additional Periph.	–	All series 200 operating below 500,000 cps			All series 200 types.
Rental Range	1,000-3,000	2,100-6,200	3,800-8,500	8,000-18,000	13,000-30,000

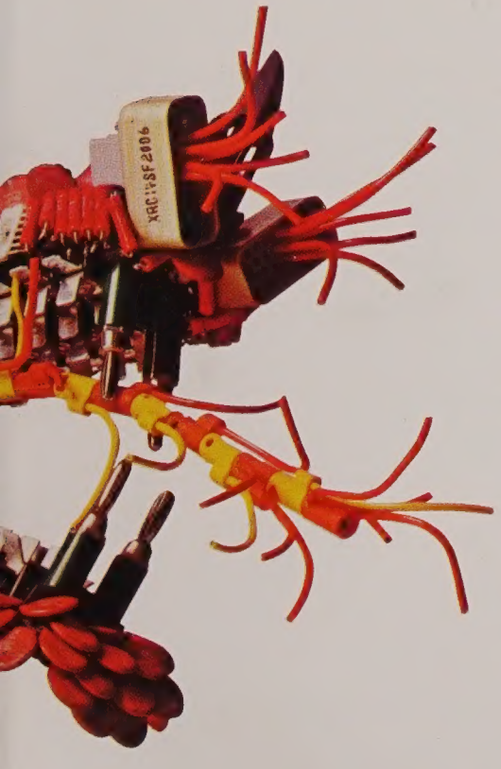
essing, GECOS uses the mass-store-link concept with a DATANET 355 and a Series 6000 disk subsystem. Communication data arriving at the 355 does not have to pass through the central system. This frees the central processor for work on active user programs. The link eliminates redundant functions, that is, the DATANET 355 can write/read remote input/output directly to/from disk without requiring central system reading or writing. Such a capability increases remote batch throughput significantly while reducing total memory load. Check 210 on reader service card.

nedium systems.

Early this year, Honeywell Information Systems announced a broad range of computer systems, peripherals, software, and applications packages. These products offer growth potential to new customers, as well as current Series 200 computer users.

A first computer or satellite—Model 58.

Small, fast, versatile, and simple to program, the Model 58 introduces great flexibility for smaller data processing systems. It uses MiniCOBOL, an abbreviated version of the USASI standard.



Model 58 comes equipped to tackle general accounting, payroll, order processing and billing, inventory reporting, and similar functions for manufacturers, distributors, business services, and many others. It fits in the office and needs no special flooring, cabling, or air conditioning. And it communicates with other 58's in standard ASCII code at up to 2400 baud.

Model 58's unique console with digital display provides complete operator control for direct transaction entry and processing. The added dimension of batch processing is supported with high-speed peripherals. It even has its own keypunch and card sorter.

A fast entry to Series 200—Model 115.

Model 115 is a fast disk-oriented system offering low-cost computer power. Either the Disk COBOL Programming System or Mod 1 Operating System offers comprehensive control, programming languages, and utility routines. Disk application packages handle accounting and inventory control and offer things such as a dedicated communications system for bankers, and Mini-APT for numerical control. New peripherals for the 115 include a new low-cost disk drive (4.6 million characters) and a new tape drive (33.4KC).

An expanded 115—Model 115/2.

Model 115/2 offers faster cycle time, increased memory, additional channel capacity and more disk storage. The Mod 1 (Mass Storage Resident) Operating System offers Disk COBOL and Fortran languages, and many utilities. The increased capability of the 115/2 can handle advanced applications packages for manufacturing, banking, and distribution. Standard hardware features for the 115 are also provided with the 115/2: automatic interrupt, advanced programming instructions, financial editing instructions, and integrated controls for disk, printer, and card equipment.

Entry System for Multiprogramming—Model 1015.

For small-to-medium users who want to stretch their data processing dollar: Model 1015 is a low-cost way to expand into foreground/background multiprogramming and real-time communications. There's speed, capacity, and simultaneous peripheral operation, plus interrupt capability and storage protection in the hardware. The expandable OS/200 Operating System allocates control and resources and provides the base for continued growth to more advanced data processing applications.

A Medium Systems Leader—Model 2015.

Extremely powerful and sophisticated, the Model 2015, with operating systems such as OS/200 and Mod 4, provides total flexibility. From single to multiple-job stream processing, plus communications and as many as five data transcription routines—operating at the same time. These systems offer the file centralization and protection necessary for data base management and data communications. And, like all Series 200 systems, Model 2015 comes bundled with basic support services, software, and application packages included in the system price.

Check 212 on reader service card.

EDINET time-sharing educates in big way.

Honeywell recently expanded it's Educational Instruction/ Information Network (EDINET) by opening a Minnesota EDINET Center. The Center is dedicated to serving about 100 schools statewide, with a time-shared Honeywell 1648 computer. During the current school year, as many as 100,000 students are expected to benefit from this system, making it one of the world's largest.

Subscribers may join EDINET for as little as $300 a month; one terminal connects the user to the total resource offering.

Computer-Based Instruction/ Learning services offer both teacher and student highly individualized educational techniques. The EDINET terminal at the school can be used for many functions: from generating tests to monitoring the instruction/ learning process of students.

Administrative and Clerical Information services can be used for diagnosis, testing and analysis of student progress . . . for prescribing individual assignments . . . and for maintaining files on students, personnel, financial and other business administration information. A special file can help in selecting an advanced educational institution anywhere in the U.S.

Consulting Services and a Users Group provide the necessary backup and access to up-to-date information and techniques on a national scale. Other EDINET Centers are now located in the San Francisco Bay area and in Washington, D.C. The latter Center will eventually service a region extending from Virginia to Philadelphia.

Honeywell will conduct a program for school assemblies to introduce both teachers and students to the EDINET concept and the use of the computer as an educational tool.

Check 213 on reader service card.

Get Your Best-Seller List.

A folder outlines our "Top 40" EDP educational publications. Education allowances are available on item quantities over 50 or 100 copies. Find out about:

- Study Guides
- Program Instruction Texts
- Lesson Plans
- Audio/visuals
- Videotapes
- Documentation supplies

Check 218 on reader service card.

Data Communications in the DOD.

Two major computer communications networks were developed by Honeywell for the Department of Defense. One system represents the largest time-sharing network installed in the Department. Dual Model 615s, with 262K words of memory, provide time-sharing service throughout the U.S. for Air Force (AF) Communications Service, AF Logistics Command, and the AF Institute of Technology.

The 615's installed at Wright Patterson Air Base interface terminals located at the following bases: Griffiss in New York, Newark Station in Ohio, Warner Robins in Georgia, Richards-Gebaur in Missouri, Tinker in Oklahoma, Kelly in Texas, Hill in Utah, McClellan in California, and Davis-Monthan in Arizona. Presently, four G-115 computers, two graphic terminals, and 39 teletypes interface with the 615's. System expansion is planned to reach 94 terminals within the year.

Another major network of 11 Model CCT-07 computer systems was set up for the Defense Supply Agency. These systems will help control and administer contracts with DOD suppliers. Communications capability will ensure up-to-date status reporting and provide for the timely payment of contracts.

Check 214 on reader service card.

More time-sharing with the new Series 1640.

Series 1640 Time-Sharing Systems were announced at the Fall Joint Computer Conference and the response has been terrific ever since.

An easy way to grow.

They offer low start-up cost at $2,995 for a Model 1642 with 32K 16-bit words of memory, 7.5 million bytes of disk storage, and the capability of handling up to 32 users simultaneously. Or Model 1644, 1646, or 1648A may provide a better entry point. At any case, all models are fully upward compatible.

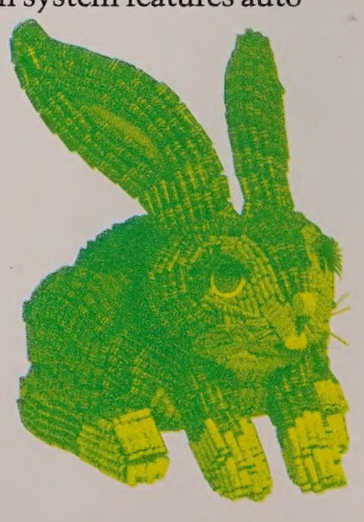
Easy to use.

Even if you do not understand computing concepts, compiler languages, or syntax, you can solve problems with Series 1640 systems in only a few minutes. Only a few commands are needed to compose, test, and execute solutions. Languages are available for both

New Data Communications Systems.

Honeywell Information Systems has introduced two remote message concentration systems and two modem by-passes for data communications functions.

The concentration systems, called the Models 1621 and 1622, use both hardware and software to convert up to 128 low-speed lines (45-300 baud) into one to four medium-speed lines (1200 to 9600 bps). Each system features auto



business and scientific applications, and many precoded programs and subroutines are on call.

Many languages available.

There are many languages available to solve problems: BASIC and Extended BASIC—fundamental compiler languages resembling Fortran but easier to use; COBOL (Model 1644 and up); Full USASI Fortran; TEACH—an interpretive language to aid in education; EDIT—an interactive context editor; SOLVE—convenient language for conversational use; and DAP-16—a symbolic assembly program. These languages are available on all 1640 systems. Also, block sizes and linkages of file systems are identical for source and data files on all systems.

Multiprocessing for low system overhead.

The unique multiprocessor configurations of Series 1640 systems vastly improve performance over comparable time-sharing systems, and the result is low overhead. Instead of multiprogramming a single computer to make it a time-sharer, the tasks are divided among various computers, allowing each to function with a simple monitor program. Check 215 on reader service card.

restart, power failure interrupt, and timer to permit the system to operate unattended. The basic Model 1621 system leases at under $1000 per month and the Model 1622 rents from $1600 per month. Both can be delivered within 90 days.

An automatic recovery option can allow programs to be loaded from the host computer, while other options include a cyclic redundancy check to permit medium-speed lines to operate with System 360 and binary synchronous communications line procedures. Both ASCII and EBCDIC codes are also fully supported.

The two modem by-passes can transmit and receive data up to 2500 feet and are considered by Honeywell to be inexpensive plug-in replacements for EIA RS 232C modems. Each operates at up to 10,800 bits per second and has a feature for use in repeater and multi-point configurations. Priced at $395, the by-pass devices can be delivered in 60 days.

Check 216 on reader service card.

New ruggedized, certified minicomputers.

Honeywell's ruggedized Model 316 minicomputer has just been certified by an independent laboratory to meet certain military specifications. The computer passed a battery of tests for shock, vibration, inclination, temperature, humidity, electrical capabilities, and altitude.

- Shock—Operating and Non-operating: 15g. (Mil-Std-810B)
- Vibration—Operating: (Mil-Std-167B)
  1. Exploratory vibration—
     5-33Hz @ .020" ± .004" D.A.
     34-55Hz @ .006" ± .002" D.A.
  2. Variable Frequency—
     5-15Hz @ .060" ± .012" D.A.
     16-25Hz @ .040" ± .008" D.A.
     26-33Hz @ .020" ± .004" D.A.
     34-40Hz @ .010" ± .002" D.A.
     41-55Hz @ .006" ± .001" D.A.
  3. Endurance—Resonant dwell for two hours/axis @ 50Hz.
- Inclination—Operating and Non-operating: (Mil-E-16400F) 45° on either side of the computer vertical axis at a rate of 5 to 7 cycles per minute in the horizontal and horizontal transverse axes.
- Temperature—Operating: 0° to 55°C. (Mil-Std-810B) Non-operating: −62° to 85°C.
- Temperature/Altitude—
  Operating: 0° to 55°C, altitude 20,000'.
  Non-operating: −62° to 85°C, altitude 50,000'.
- Temperature/Humidity—
  Operating: 95% RH, 30° to 55°C, five days.
  Non-operating: 95% RH, 30° to 71°C, five days.
- Electrical—Operating: supply line voltage, transient voltage, and transient frequency per Mil-E-16400F.
- Electromagnetic Interference: (Mil-Std-461A, 462, 463).
  Conducted Interference—
  20KHz to 50MHz, power leads.
  Conducted Susceptibility—
  30Hz to 50KHz, power leads.
  50KHz to 400MHz, power leads.
  Spike, power leads.
  Radiated Emission—
  30Hz to 30KHz, magnetic field.
  14KHz to 1.0GHz, electric field.
  Radiated Susceptibility—
  30Hz to 30KHz, magnetic field.
  14KHz to 1.0GHz, electric field.
  Magnetic Inductance field.

Check 211 on reader service card.

Keyplex moves mountains of data.

Both the earth mover and Honeywell's new Keyplex system pictured below have the power to handle big jobs efficiently. A Model 5500 Keyplex system can move the mountains of data that are burying many key-punch operations. And save money besides.

It's processor-controlled. Simultaneous input from multiple keystations is merged by the system's computer and temporarily stored on disk for subsequent batch output to ½-inch magnetic tape, 7- or 9-channel. Card-to-tape translation is eliminated for a savings in main computer time.

It offers record flexibility. The system accepts record sizes of from eight to 400 characters, with record sizes variable from job to job. A variety of jobs with different record sizes can be entered simultaneously. And as many fields can be used as the application warrants.

It provides nearly unrestricted source document formatting. Up to 999 program formats may be stored in the system library at one time, and all are easily accessible to the operator.

It helps to purify source data. System features help operators identify and eliminate most source errors before the data goes on tape for computer use.

It makes error correction simple. When an operator hits the wrong key, she simply backspaces and rekeys. Experience shows key-to-disk operators typically correct 80% of their errors as they enter data, without loss of speed.

It simplifies verification procedures. Verification may be performed at the entering station after a batch is complete, or any other keystation may begin verifying as soon as the first record is complete.

It reduces your personnel requirements. About 25% fewer operators are required than were needed with keypunch equipment. And the operators are happier with Keyplex, because they're operating more efficiently, more effectively, and in more pleasant surroundings.

It includes a full line of related attachments, such as communication devices and printers.

It's priced right. A Model 5500 with a maximum of 64 keystations per control, 7.2 million bytes of disk storage, and tape drive rents for $1,400 plus $85 per station per month.

It's backed by Honeywell's extensive operator training program, a 3,000-man field engineering force, computer systems expertise, and more than three years experience in key-to-tape/disk data entry.

Check 217 on reader service card.

Many proven application packages.

Honeywell has valuable packages for just about every industry and commercial business. Here are a few examples.

Manufacturing. Factor—management information and control system for manufacturers: many packages for key manufacturing needs; e.g., inventory forecasting and control, bill of materials processing, and numerical control.

Banking. Accounting packages for demand deposit, savings, mortgage loan; local and remote MICR entry; customer information file processing.

Distribution. Inventory simulation, forecasting, and control packages with comprehensive reports.

Medical. Single Hospital or Hospital Computer-Sharing System (HCSS) for accounting and administrative chores.

Education and Government. Packages for student scheduling, computer-assisted instruction, and real estate tax accounting.

Many others. Packages are also available for retailing, insurance, media systems, research and development, and engineering design.

Quality Disk Packs.

From raw materials to final testing, Honeywell disk packs meet the highest quality control standards. It's the little systems and procedures we go through that ensure you won't lose a bit of information. They come in all sizes; they're industry compatible, and they're priced right.

Check 219 on reader service card.

For more information about a specific product or service, check the appropriate numbers on readers service card or just drop a note to Honeywell Information Systems (MS 061), 200 Smith Street, Waltham, Massachusetts 02154.

The Other Computer Company:

Honeywell

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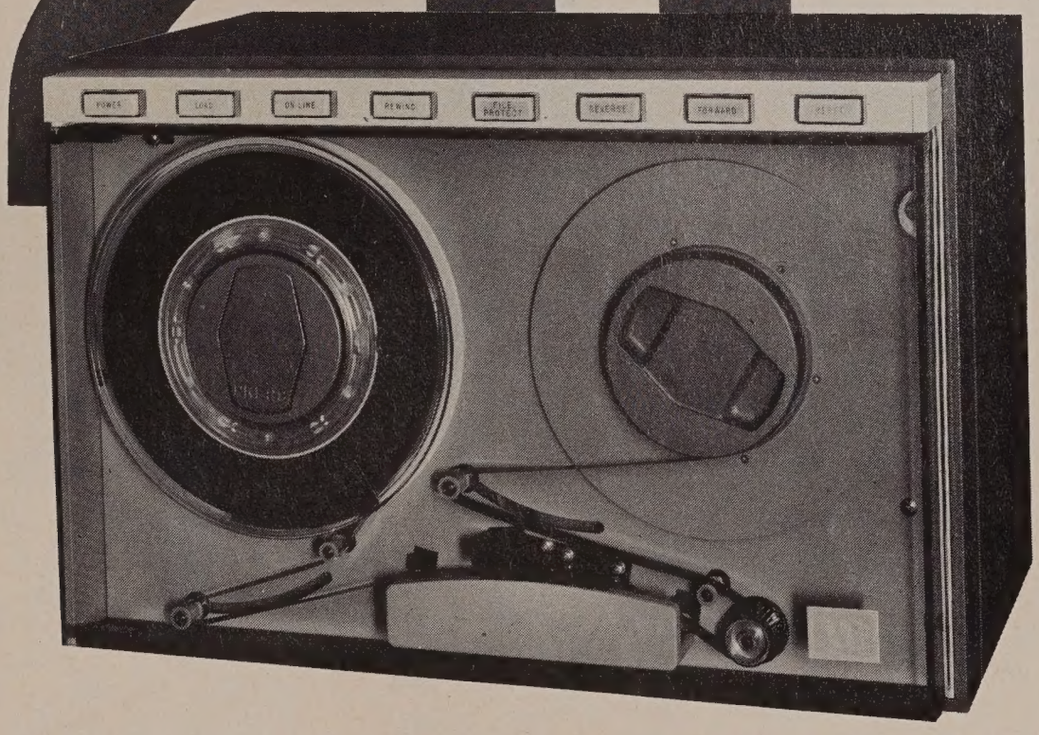

New high performance ...same low cost

The new Wang Mod 825 combines high performance, small size and a cost of less than $3000 in OEM quantities. The Mod 825 needs only 12¾ inches of 19 inch rack space to bring to your system performance equivalent to higher priced tape drives. It takes up to 8½" tape reels, and reads and writes data at 200, 556, 800 and 1600 cpi, NRZI or phase encoded.

If the 825 is too fast for you, try the Mod 812, at 12.5 ips. It has the same operator convenience, reliability and ease of maintenance that have made other Wang tape drives the first choice of computer, keytape and other data processing equipment manufacturers.

Whether you're looking for 75 ips vacuum column design, or the high performance and low cost of the Mod 825, check with Wang first. As a start, write for complete information of the 825 and other Wang tape drives.

WANG COMPUTER PRODUCTS, INC.
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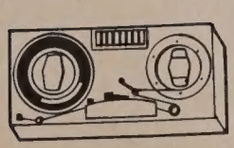
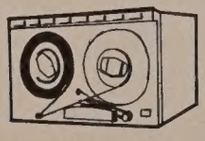
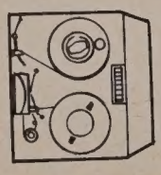


MOD 712



MOD 812



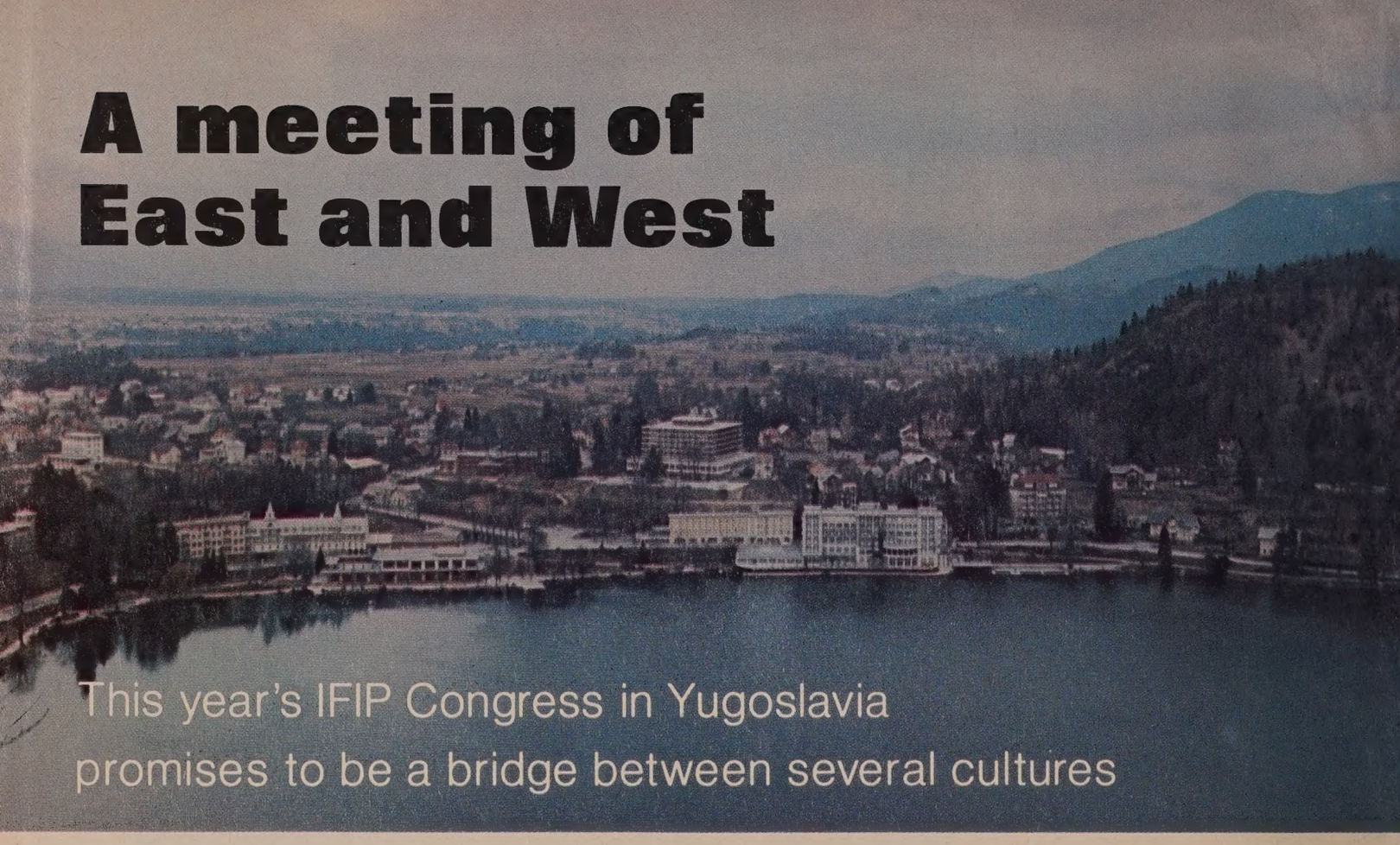
MOD 1025/37/45

MOD 1075

FORMATTER

INFORMATION RETRIEVAL NUMBER 10

A meeting of East and West



This year's IFIP Congress in Yugoslavia promises to be a bridge between several cultures

by Jeffrey N. Bairstow
Managing Editor

Almost centrally situated in Europe, and neither a truly Western nor a truly Eastern country, Yugoslavia stands as a link between several cultural and political cultures. Thus Ljubljana, in Slovenia, the northernmost province of Yugoslavia, makes an ideal site for an international computer conference, the IFIP (International Federation for Information Processing) Congress 71, to be held August 23-28.

Some thirty countries are represented in the technical program and there will be over 80 exhibitors from some 20 countries. Although U.S. influence will be dominant with nearly half the papers coming from U.S. authors and nearly half the exhibits coming from U.S. firms or their European affiliates, there will be strong showings from the United Kingdom, the U.S.S.R. and from France.

In previous years, the IFIP Congresses have tended towards the academic with a heavy emphasis on mathematics and university research work. This year, the organizers have made a definite effort to broaden the scope of the Congress with papers, panel discussions and invited speakers, covering business applications, MIS, the humanities and process control, in addition to such academic subjects as numerical analysis and linear algebra. The invited speakers will be presenting either one-hour survey papers or shorter papers on more specialized topics. The surveys will range from Jack Kilby of Texas Instruments looking at large-scale integration and its affect on computer hardware, through Professor D. Kendall of London University examining mathematical methods in archaeology to Jacques Maisonrouge of IBM World Trade Corp., discussing MIS. Preprints will be available for all papers (in English) and most of the papers will be presented in English although questions will be accepted in English, Russian, Spanish and French.

The sessions will be held in five separate locations, the Union Cinema, the Komuna Cinema, the Philharmonic Hall, the Tivoli Hall, and the Festival Hall (see map). Ljubljana has a very compact town center so all the halls and the exhibits at the Fairgrounds will be within easy walking distance although shuttle transportation will be provided. The Festival Hall is on the same site as the Fairgrounds (near the railroad station). The Fairgrounds consist of a series of modern exhibit halls with restaurant and meeting hall facilities on the same site. The Fairgrounds are in continuous use for a variety of exhibitions—the next show after the Congress will be the annual wine festival. Among the exhibitors will be the Mihailo Pupin Institute of Belgrade which will be showing some of the process control equipment, including computers, which the Institute manufactures. Hungary, the U.S.S.R. and Czechoslovakia will also be represented with exhibitors in addition to most of the other European countries.

The site of the conference, Ljubljana, is the capital of Slovenia, one of the six provinces of Yugoslavia. Ljubljana is a city of some 200,000 people which contains some surprising contrasts between the old and the new. The old town of Ljubljana is still distinctively medieval with narrow streets and market vendors hawking fruit, flowers and vegetables. However, on the outskirts, Ljubljana is an industrial town with electronics and other high-technology industries. The language of the people of Ljubljana is Slovenian but many people speak some German, Italian or English. Slovenia is obviously a prosperous region and the people of Ljubljana reflect this prosperity. There

are many stores and restaurants in the city and traffic jams are not uncommon.

For a more restful stay, particularly if you're bringing your family, the nearby resort of Bled can be highly recommended. The town of Bled is on the edge of Lake Bled, a small but beautiful Alpine lake with a tiny Slovenian church on an island in the center (see photo) and dominated by a castle on the top of a massive cliff. Bled has many recreational facilities for the family or for the tired convention-goer.

The Yugoslav unit of currency is the dinar—about seven cents, since there are 15 dinars to the dollar. The dinar is also divided into 100 para. Traveller's checks and U.S. currency are acceptable everywhere, sometimes with 10-20 percent discounts.

Getting there

Flying to Yugoslavia poses hardly any more problems than a flight to any European country. There are no direct flights from the U.S. into Yugoslavia but Yugoslav Airlines (JAT) and other European carriers fly from most major European cities into Zagreb or Ljubljana using DC-9 jets or similar equipment. Because of the six-hour time difference between New York and Ljubljana it will take you almost twenty-four hours door-to-door although the actual flying time will be under twelve hours. Visas can be obtained free of charge at the airport.

The big problem for most travellers will be to decide on the price that they are prepared to pay for the trip. Regular Economy fare (unlimited stopovers) New York-Ljubljana is $704 in August. A 17/28-day excursion fare (two stopovers permitted in both directions) comes to $489 and a 29/45-day excursion will cost $380. A better bargain can be had by joining either a charter flight or an 'affinity group' (no stopovers). Both the IEEE and the ACM are offering charters (15-day) from New York to Lubljana for approximately $245. AFIPS, through Cook's World Travel Service, is offering a series of 'affinity group' trips based on a minimum of 40 persons traveling together (Cook's will assemble the groups). The AFIPS trips range from a five-week, $292, New York-Amsterdam flight (find your own way to Yugoslavia and back to Amsterdam), to a one-week, $350, New York-Ljubljana round trip.

If you're not already thoroughly confused, you could also investigate using a package deal provided by one of the scheduled transatlantic carriers. For example, BOAC offers one week in London (with accommodations) plus two weeks on mainland Europe with a Volkswagen or similar auto, with 1,000 free kilometers, for $455. All the airlines have similar variations on this theme. A good travel agent can probably sort something out to fit your schedule and pocket.

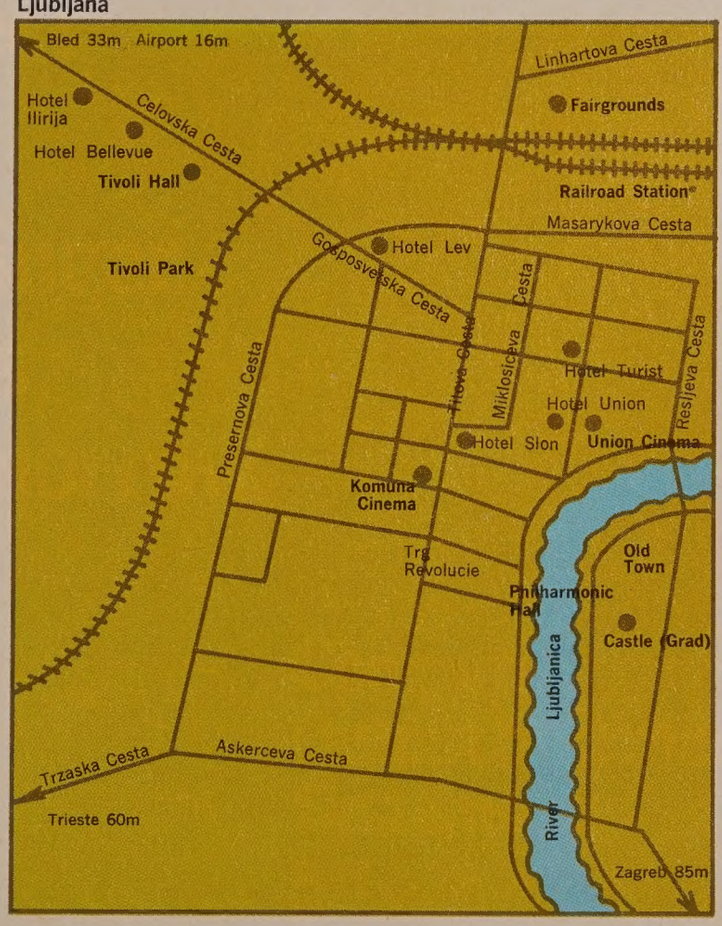
Once in Yugoslavia, transportation will be available from Ljubljana and Zagreb airports into the town center. A rented car is not really necessary since all the Congress meeting halls and exhibits are within walking distance of the hotels. However cars can be rented for about $6 a day plus 9¢ per km (small Mercedes).

Where to stay

Although there will be sufficient accommodation in Ljubljana and the surrounding area, good hotels are in short supply and reservations should be made as soon as possible (see **More information** below). Rooms can

Slovenia (Northern Yugoslavia)

Ljubljana



also be obtained in private homes for $2-$3 per person, including continental breakfast.

If you're intending to take your family then you should probably stay in the Alpine resort of Bled, about 30 miles from Ljubljana. Although Ljubljana is a very pleasant town, the hotels are all in the center and lack recreational facilities such as a pool. Furthermore, Ljubljana is a busy town and the Yugoslavs all start work at 7 a.m. or earlier. Traffic noise can be considerable from 5:30 a.m. on.

Ljubljana hotels

Lev, 320 beds, Grade A, Vosnjakova 1. The Hotel Lev (lion) is a modern hotel within easy walking distance of Tivoli Hall and the Fairgrounds. Rooms are well-appointed and the hotel has a good restaurant and a 'night-club.' Recommended. Approx. $10 per person.
Slon, Titova Cesta 10, 180 beds, Grade A. The Hotel Slon (elephant) is an older European-style hotel. The rooms are comfortable and the service is generally good. There is a casino in the hotel (foreign guests and currency only). Recommended. Approx. $8 per person.
Union, Miklosiceva Cesta 1, 370 beds, Grade B. Despite the rating, the Hotel Union has a new section that is worth a Grade A. It is in the middle of town so ask for a room away from the main street. Approx. $8 per person.

Other hotels are the **Turist** (Grade B, central and adequate), **Ilirija** (Grade B, away from center) and the **Bellevue** (Grade C, very small). For the independently minded there is an adequate camp-site on the outskirts of Ljubljana (Autocamp Jezica).

Bled hotels

Golf, 410 beds, Grade A. Excellent new hotel with superlative views of Lake Bled. Fine restaurant and well-appointed rooms. Indoor and outdoor swimming pools, tennis, etc. Highly recommended. Approx. $9 per person.
Toplice, 204 beds. Grade A. A deluxe hotel in the European tradition—possibly one of the best hotels in Yugoslavia. Excellent restaurant with good service. Indoor and outdoor pools, private beach, etc. Highly recommended. Approx. $10 per person (in main hotel, less in separate annexes).

Other hotels in Bled include the **Kompas** (B), **Park** (C) and the **Lovec** (C). President Tito's summer residence, **Villa Bled,** is being converted into a hotel and should be open by mid-summer.

After the sessions

Dining. Although Ljubljana is a major city it is not exactly overflowing with good restaurants. All the Grade A hotels do have competent restaurants; however, it can be worthwhile to explore the restaurants that are not attached to the hotels. Look for signs that say *gostilna* (inn), *bife* (buffet), *kavarna* (cafe), or *slascicarna* (teashop). Try the Zlatorog, Zupaniceva 9, or Privitezu, Breg 18. Slovenian will be an unfamiliar language for most Congress visitors, but waiters frequently understand German.

Slovenian food resembles that of Austria but with Balkan overtones—it can be highly seasoned, so be careful! Meat is generally good and is often marinated with wine before being grilled. It can be difficult to get rare meat. The appetizer usually consists of a variety of delicious smoked cold meats. The main dish will probably be a variety of grilled meats—try *raznjici* (pork) and *cevapcici* (meat balls). Incidentally, *c* in Slovenian is pronounced *ch* and the *j* is treated as a *y*. Desserts are very sweet and vary from the Austrian *strudel* to the Turkish *baklava*. The wines of Yugoslavia are cheap and eminently drinkable with Yugoslav food. Steer clear of the plum brandy, *slivovica,* unless you have a strong constitution. Coffee is mostly of the Turkish variety, *kava turska,* strong, black, sweet and in tiny cups. Sip it slowly and you'll get to like it.

Lunch and dinner are substantial meals in Yugoslavia so you'll find that breakfast is usually coffee and rolls (included in the room price). Fruit juice and boiled eggs are possible if you're persistent enough.
Shopping. Ljubljana has plenty of good stores. There is no apparent lack of consumer goods in Yugoslavia. Leather goods are especially reasonable and peasant arts and crafts are readily available. Look for stores marked *Dom* (home) for peasant articles. Discounts can often be obtained if payments are made by traveler's check or U. S. currency. Stores are mostly open from 8 a.m. to 8 p.m. but smaller shops are open 8 a.m. to noon and 4 p.m. to 8 p.m. All-day opening shops are called *non-stop*.
After hours. Most of the entertainment in Ljubljana is provided expressly for tourists. The Hotel Slon has a casino open only to foreign visitors, and several hotels have night-clubs where a version of a Western strip-tease is performed. Something a little more ethnic can be had during the summer Festival of Ljubljana—various activities indoor and outdoor—check with your hotel. Ljubljana also has an opera house with visiting national and foreign companies.

More information

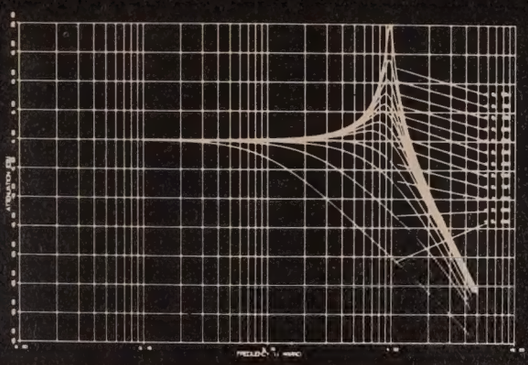
General
U.S. Commitee for IFIP Congress 71, Box 4197, Grand Central Station, New York, N. Y. 10017.

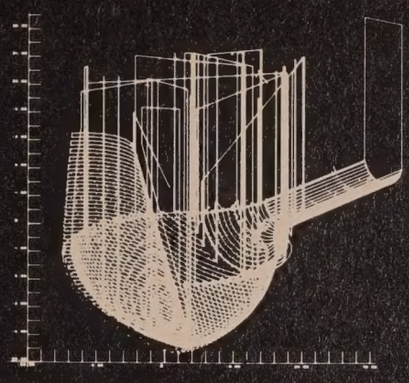
Travel
Arthur E. Hutt, Bowery Savings Bank, 110 East 42nd Street, New York, N. Y. 10017. (212) 697-1414.

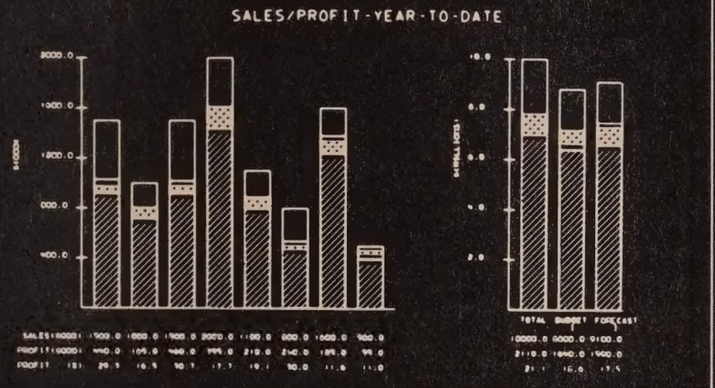
Registration and accommodations
Jack Rosenfield, IBM Thomas J. Watson Research Center, Yorktown Heights, N. Y. 10598. (914) 945-1953.

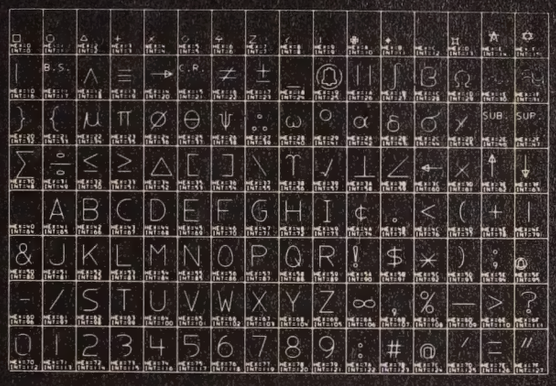
Exhibits
Richard F. Welch, Univac, P. O. Box 8100, Philadelphia, Pa. 19101. (215) MI 6-9000, x2132.

About Yugoslavia
Yugoslav State Tourist Office, 509 Madison Avenue, New York, N. Y. 10022. (212) 753-8710.









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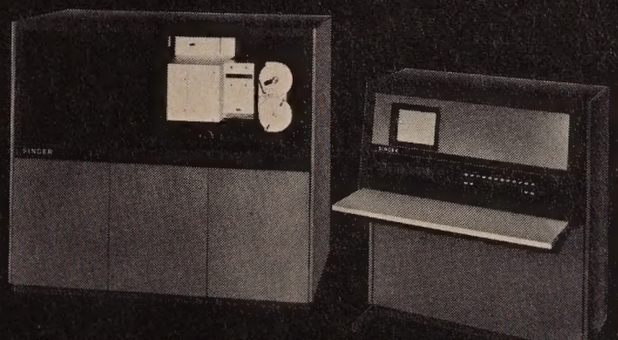

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INFORMATION RETRIEVAL NUMBER 11

Indexing is the key to retrieving COM-stored data

By Michael G. Bird
University Computing Co.
Van Nuys, Calif.

In order to take advantage of the benefits of storing data on microfilm, you have to be able to retrieve efficiently the data you store. There are several methods available for indexing microfilmed output, and a knowledge of these can help you to use this new technology to your best advantage.

The indexing techniques employed to retrieve microfilmed data are generally determined by the software available to the host computer. However, some of the more sophisticated COM recorders contain small computers which can be programmed to assist in this indexing function. The choice of indexing method depends on the volume and type of data stored, and on what the user wants to go through to retrieve this data. Within a single company, there may be several indexing approaches for various applications. Although he is somewhat limited by the hardware available (computer, recorder, COM terminals), the user can, if he is familiar with the techniques available to him, choose a retrieval method that satisfies both his needs and those of the COM system.

Computer-output-microfilm—produced directly from computer-generated data by a COM recorder (see *"Microfilm cuts computer data down to size,"* March, p. 22)—is generated in two basic forms: roll film and microfiche. The roll microfilm is normally on 16mm or 35mm film with the data frames arranged like the frames in a motion picture film. For retrieval, the roll will either be loaded into a cartridge or cut into "sticks" which are strips usually about 15 frames long. A microfiche is a sheet of film, commonly about four by six inches, with data frames arranged in rows and columns.

Like conventional microfilm, the detail on a COM frame is too small to be read by an unaided eye, so special viewers are used. Roll film may contain 2,000 or more frames per cartridge and microfiche about 200 frames. This means, of course, the viewers must have the capability to seek out and select the proper frame for viewing which, in turn, requires a suitable means of indexing the frames.

Indexing microfilm in cartridges

In order to be practical, data stored in COM cartridges must be retrievable by reference to names, account numbers or social security numbers. To do this, an index is required to direct the user to the information in the easiest, most direct manner.

The index itself is extracted and stored by the computer while the data frame tape is being prepared. The simplest index is the one appended to a microfilm roll, and prepared from information accumulated during the data recording cycle. Usually, this is printed on the last frames of the roll (see chart to right). As the program completes each data frame or frames, it stores the identifying key and frame location in memory. After the file has been put on a COM tape for a specific segment of data, the program pulls the index information out of stored memory and adds it to the same tape. The tape is then run through the COM printer and the index is included on the end of the microfilm roll. For ease of retrieval, the index is then cut off and spliced to the front of the microfilm roll and the film is ready to be duplicated and loaded into cartridges as required.

The computer program controlling this operation is written to number sequentially the data frames, and also to take into account the length of microfilm roll the cartridge will accommodate. For every 2,000 frames, for instance, which is the number of frames for a typical cartridge, the program must pick up the index from storage and transfer it to the end of the COM tape. That particular tape is then closed for transfer to the COM printer and a new tape is mounted on the transport to start COM processing and indexing for the next segment of data in the file being recorded. This operation is repeated until the complete file is recorded on a series of COM tapes—each with its own index. Good practice usually provides for some blank advance between the last data frame of each tape and its index so there will be some leader to work with in the cutting and splicing operation.

Indexing data stored on microfiche

The microfiche is generally filmed on 105mm roll stock, which is slightly more than four inches wide. After processing and duplicating, the microfiche are cut to separate the fiche from the roll stock form.

A typical indexing format for a fiche is to assign numbers to the rows and letters to the columns. In that way, any frame can be located by a number in conjunction with a single letter: 7G, 3C, 5D, etc. The computer is programmed to generate and store the index while the data tape is being prepared and it is called from memory at the proper time to be entered on the fiche—usually in the last frame of the lower right-hand corner. In this case, of course, since the tape will contain data for many fiche, the index call-in from memory will be more frequent than it is for roll film—once for each fiche.

Here's how to get out of your COM system the data you put into it by effective indexing

On microfiche, retrieval is simplified by two methods which produce titling large enough to be read with the unaided eye. These methods are programmed titling and hardware titling. Programmed titling requires the electron beam of the cathode ray tube in the COM printer to literally paint the characters in the title. This requires detailed instructions to control the beam and, therefore, consumes significant amounts of COM control tape and computer memory (8k to 10k).

Hardware titling is achieved in the COM camera itself and requires relatively simple coding instructions. It can generally be done with less than 2k of memory and is available on UCC and Kusuda (Japan) COM recorders. Two bars of small lights are fixed in the camera perpendicular to the direction of film movement. To form a character, the film is moved in discrete steps while the proper light or combinations of lights is illuminated at each step. This is similar to the way news highlights move across illuminated signs in some cities.

Titling of the fiche is large enough to read with an unaided eye. It does occupy one or more rows that otherwise might be used for data frames, but it provides a very convenient look-up system. If fiche are mounted in a stand-up notebook they can be color-coded or index-tabbed to represent various reports and further reduce look-up time.

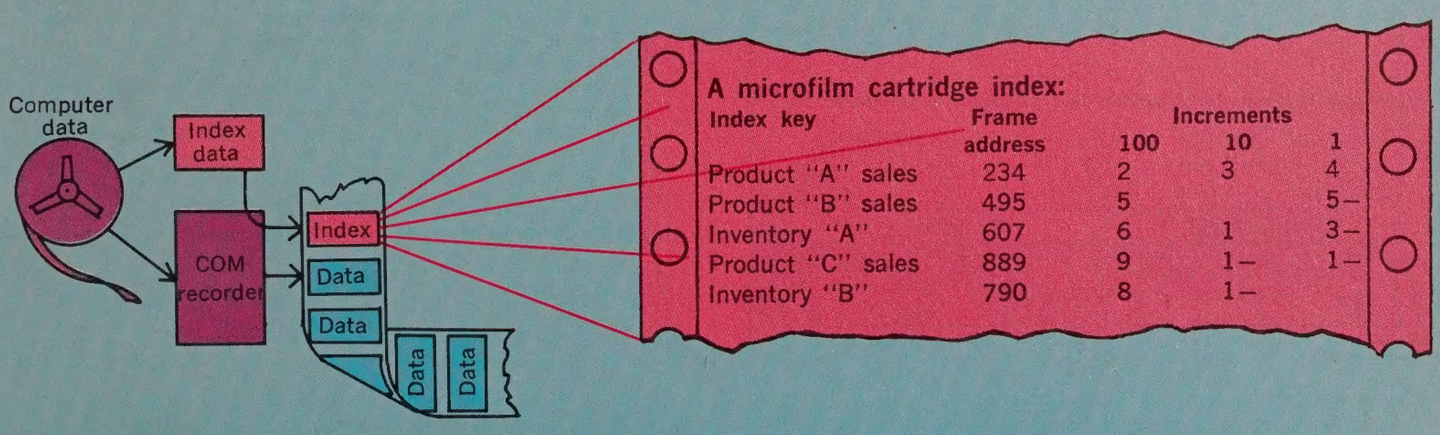
There are situations where regularly prepared reports are combined with special or variable reports. This might be a financial analysis that always contains such reports as "profit," "loss," etc. combined with one-time reports of "equipment sell-off" or other non-recurring items—all broken down into various departments. In these cases, special COM formatting can be used to advantage.

Microfiche is well suited for this type of display. Each department can be assigned a six-character alphanumeric code which will occupy the first three columns in their respective rows. Assigning two rows of detail frames to each department will permit them to separate the standard, or static, reports from the variable reports. For every fiche prepared for this use, the static reports will always appear in the same location; therefore, those positions may be labelled on the fiche reader with their respective designations, which will speed up the retrieval.

Getting there fastest with the leastest

Finding a specific frame somewhere—anywhere—in a 2,000-frame cartridge is not at all difficult when available retrieval aids are used. One aid is a viewer that will advance the microfilm in a cartridge in discrete increments of one frame, 10 frames, or 100 frames per depression of the appropriate button on the viewer console. The viewer also provides for movement of the film in the reverse direction. Incremental count by the reader is accomplished by a retrieval mark under each frame. The retrieval mark is gen-

How an index grows:



As the data is printed on microfilm by the COM recorder, index data is extracted and stored. At the end of each cartridge or microfiche, the index is printed onto the film. When used with a terminal equipped with forward and reverse increment buttons, the COM index not only gives the frame address of the data but also tells the user how many times each increment button should be pushed to arrive at the desired frame.

COM indexing . . .
(Continued)

erated as a hardware function of the COM recorder.

The computer program for indexing can be written to calculate the number of times each increment button has to be pushed and in which direction the motion should be to locate a specific frame. In this case, the index will identify the key to the item wanted, the frame number, and then, in three columns, the number of times each of the specific increment buttons is to be depressed. For example, to locate the inventory information on product "A," which is indexed as frame number 607, the 100-frame advance button would be pushed six times (600), the 10-frame advance button once (610), and the single-frame reverse button three times (601-3)—see chart on previous page.

In sophisticated systems, combining the reader's hardware feature of automatic increment control with a computer program can eliminate the need for a separately compiled index.

Key letter indexing—just like a dictionary

Another form of indexing is the key letter approach. In this case, the COM recorder prints an enlarged letter, or set of letters, at regular intervals along the film.

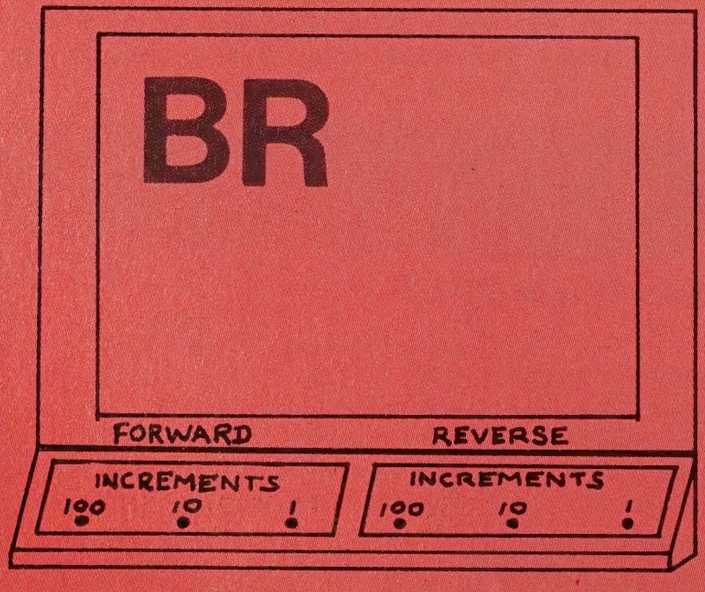
In relatively simple and smaller COM files, the key may just be a single letter (A, B, C, etc.). In larger files, the key may incorporate two or more letters (AA, AM, AW, BA, BJ, etc.). If the COM file is organized according to account numbers, the last three or four digits or appropriately spaced numbers could form the key. On most systems up to a dozen alphanumeric characters can be accommodated in the space available for the key. In operation, the key letter works much like a dictionary's thumb index. The operator, in searching for a specific detail, will always go to the next higher key beyond the detail and then back-track to zero in on the desired detail. As an example, if the operator is looking for a detail on a Mr. Brown, she would watch the enlarged keys as they appeared on the viewing screen and when she observed a "BT" following a "BL" key, she would know that she has passed Brown ("BR"). She would stop the viewer on "BT" and start backing up in search of Brown.

The interval between the keys must equal one of the automatically controlled increments available on the reader—usually the 100-frame increment is used. The computer program will look at the last detail prior to the space reserved in each hundredth frame for the key and generate a key based on this detail. If the last detail happened to be Brown, the program would generate "BR" (see below, left), and put it in the reserved space. Once any key is displayed on the viewing screen, every push on the 100-frame advance button will bring the next higher key into view.

Codeline look-up—indexing on-the-run

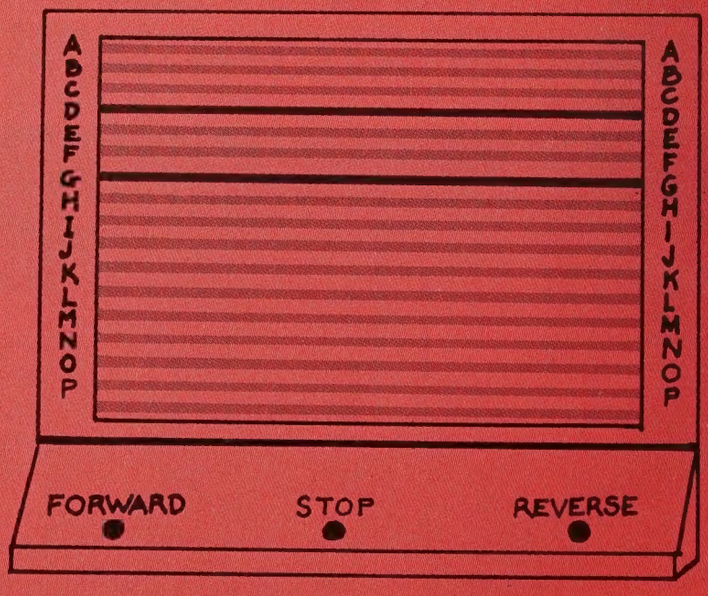
Rapidly transporting a cartridge of microfilm through a reader and watching a "codeline" move up or down is another way to find a required detail frame. The COM reader terminal will have some sort of an indexing key (such as the letters of the alphabet) inscribed on either or both edges of the viewing screen perpendicular to the direction of film movement. As the film speeds by, squares or bars that have been added to the film will appear as a solid line at the level corresponding to that particular position in the

Key letter indexing for cartridges:



When the key letter approach to indexing is used, large letters or numbers are printed at set increments (usually every 100 frames) along the film. As the film goes by, it automatically stops for a moment at each of these increments, displays the enlarged letter or number code, then increments to the next code. In the case above, the data preceding the increment step shown begins with "BR."

Codeline indexing aids the search:



In the codeline indexing technique, the COM recorder prints a solid line of blocks to replace one or more lines of characters. As the film speeds by, this line of blocks appears nearly black while the other lines of characters appear grey. The dark line(s) correspond to a fixed set of codes on the edge of the viewer. In the above case, the data speeding by has an index address of "D,G," as indicated by the dark lines.

cartridge. That is, if the indexing breakdown used happens to be alpha characters and the section passing through the viewing screen is section "D-G" the codeline will coincide with the stationary letters "D" and "G" inscribed on the edge of the viewing screen (see the right-hand drawing on facing page).

While generating the COM tape, the computer program will be keeping track of the indexing position and will program-generate a line of squares at the appropriate level in the detail frame. This is usually accomplished by printing a solid square in place of alphanumeric characters in each character position on the proper line, normally, a line of 132-characters. Although the solid square will appear as a solid line when moved through the viewer at high speed, the detail character lines will appear as much lighter streaks. Conventionally, one or two blank lines are left above and below the solid square codeline to increase the contrast for viewing.

An alternate method of programming a codeline is to leave several detail lines in the frame blank at the appropriate levels. The codeline then appears as a spaced streak when sped through the viewer.

In recorders which can generate these codeline via hardware, the function will be identical—that is, display solid lines on the speeding microfilm to identify the detail section. These lines, however, are located between the detail frames instead of in the frames themselves.

The Miracode approach

Another look-up scheme has been developed by the Eastman Kodak Company and is marketed under the registered acronym, "Miracode" (microfilm information retrieval access code). This system incorporates a special viewer terminal that optically reads code marks on the microfilm. The code marks are columns of bars between the detail frames and each column represents three decimal digits identifying the particular detail frame to which it is associated.

Fifteen columns of code representing 45 decimal digits can be recorded on microfilm for index retrieval. Look-up is simply a matter of entering the identifying code into the console and pressing the search button. The code columns will be scanned by the optical system and the viewer will halt the microfilm at the correct frame.

A separate microfilm index

For very large information systems where look-up time is not a critical factor, a separate microfiche or cartridge can be used for the index. This index will locate data by frame number as before, but first, it will be required to identify the microform (microfiche or cartridge) where the frame resides. Using this indexing concept is a two-step operation. The index microform is placed in a viewer and the index information relating to the data desired is obtained. Next, the identified microform is placed in a viewer and the required frame is located using the index information.

Typically, a system large enough to require this type of indexing would probably have several viewers, with one reserved for the index and the others each assigned to specific microforms containing the information details.

With the exception of index processing, the large, separate index file is generated in a fashion quite similar to the smaller files with attached indexes. This time, instead of the index being stored for recording on the end of the COM data tape, the index is generated on a separate tape.

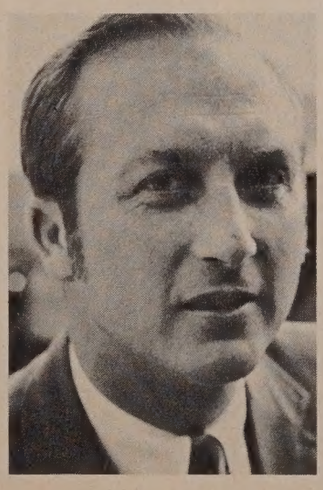
Updating the data and the index

After the original file has been produced, subsequent transactions that affect any of the recorded data are accumulated and put on a computer tape called the transaction file. At specific intervals, these transactions are entered into the system to update the records and produce a new index tape. In the updating process, the computer program searches the transaction file for those frames of data that have been changed. When a frame and transaction match is found, the frame is updated accordingly and passed to the new data microfilm tape. It is also assigned a new index position related to its position on the new data tape. The new index position replaces the old position and is written on the new index tape.

The new COM data films are then sent to the printer. The previous data microforms are retained since they still contain the only records of the information unchanged by transactions. However, the COM index has been completely rewritten, including the unchanged index information, so the previous index microform can be destroyed.

The unchanged version of details affected by transactions still exist on the retained old data microforms, but they are not referenced on the latest index and, hence, cannot be located through that index. If, for some reason, there may be occasion to refer to the previous versions of any detail, the preceding index tapes should be retained as they will be the only source of index information to these versions.

Periodically, the master file should be reoriented in normal sequential manner to eliminate the unreferenced details remaining in the previous data tapes. If this is not done at reasonable intervals, the file will become unwieldy and chaotic. □



Author Michael Bird has spent nine years in the data processing field with such firms as Stromberg DatagraphiX, IBM, Honeywell, and Univac. His present assignment for University Computing Company takes him to Tokyo where he is general COM support consultant.

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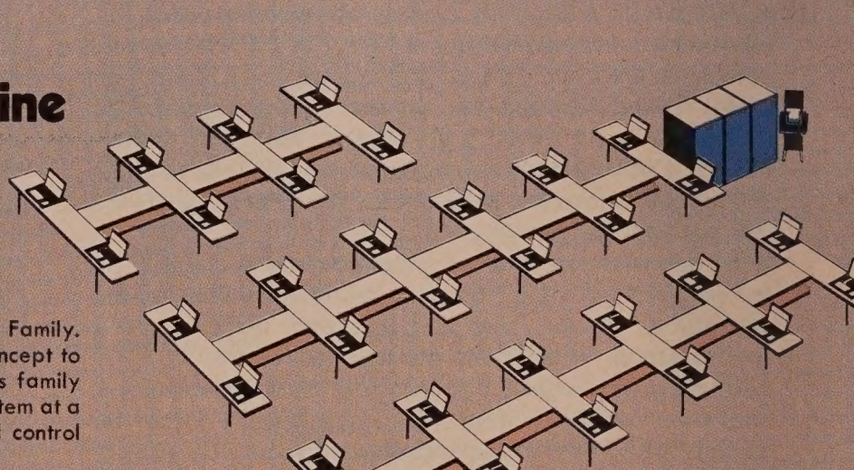

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Cut input costs with key-to-tape devices

Key-tape devices can cut the skyrocketing costs of data entry but users must know what they can do and how they work

by James H. Bauch
Data Action Corp.
Minneapolis, Minn.

Since 1950, the number of computer installations in the United States has increased from 600 to more than 70,000. Along with this increase has come vast improvements in machine speed and efficiency. To take advantage of these improvements, more people have been required to keypunch data for input. The result: almost one out of every 100 employees is involved in keypunching data—a total of more than 600,000 people in the total U. S. work force of 70 million. For the large-scale user, these labor charges have shot the cost of data preparation upwards at a rate of about 20 percent per year, with anywhere from 30 to 50 percent of the total budget of most edp installations spent for input charges.

The problems of skyrocketing input charges and the need to keep pace with the rapidly increasing amounts of data required by newer computer systems resulted in the creation of key-to-tape devices, a concept introduced in 1965 by Mohawk Data Sciences Corp. with their Data-Recorder.

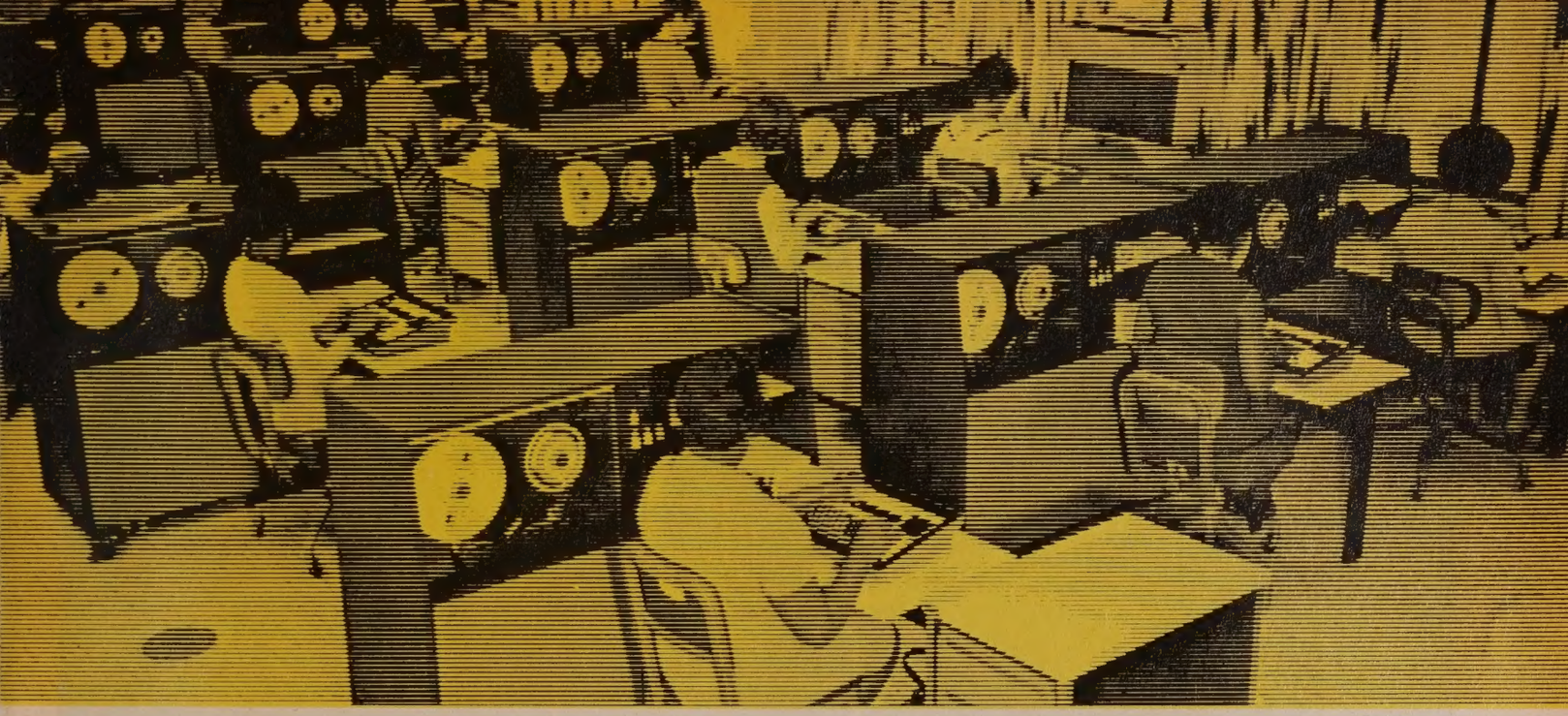
Key-tape machines come in various versions

There are various types of key-tape devices available today. All, however, are characterized by certain common features: all are used to key-record data onto a tape which can then be read by a computer; all include a tape-transport mechanism; all employ a keyboard for recording data—either one similar to that of a keypunch machine, or similar to that of a typewriter; all include a display—usually coded—which permits the operator to view what is on the tape (with some units, the operator has a crt display, and can view the entire record); all key-tape devices have some kind of control console so that special functions, such as setting record formats, can be performed. Two different types of key-tape configurations are available to users: stand-alone and key-to-central-tape. Stand-alone devices such as the Singer-Friden 4300, the Honeywell K-900 and the Mohawk 6400's comprise the majority of key-tape units on the market. They are self-contained, and each has its own tape unit built into the data-entry station. These units are generally of two types, depending on function:

First are keypunch replacement devices which normally have identical keyboards, and are found typically in a central keying office where they replace keypunches on a one-for-one basis. These key-tape devices use standard one-half-inch computer tape, cartridges or cassettes, depending on the manufacturer. While ½-inch magnetic tape can be used directly by the computer, generally the individual reels are "pooled" onto one reel to cut down on set-up time. In operation, data that is keyed on these machines is generally stored temporarily in a buffer. When the entire record has been keyed, it is written on the tape from the buffer. This technique is used in order to make possible appropriate packing densities on the tape (for example, one user may require 800 bits per inch, another 1,600 bpi). Some units, however, key directly to the tape.

The second type of stand-alone device is used for recording of source data, a function commonly served by a combination of a standard typewriter and a magnetic-tape cassette or cartridge unit. The typewriter not only produces hard copy, but records data on tape simultaneously. It has applications wherever data is created, and can generally be used by a typist, without special training. The chief advantages of using a cassette or cartridge are: easier operator training and handling (no loading procedures for the operator to worry about), and the larger flexibility provided by keying in relatively small batches. A typical example is the Data Action Typescribe which interfaces to a standard IBM Selectric Typewriter. This device employs a cartridge tape which is converted to standard one-half-inch tape for processing.

The key-to-cartridge (or cassette) manufacturers offer a number of different approaches. Some use a standard Philips cassette which is of the same type



used on small tape recorders. This cassette usually contains 300 feet of tape which has a capacity of 200,000 characters of data. Other companies utilize a special cassette designed especially for use in their particular product. Normally the data keyed is temporarily stored in a buffer as with computer tape.

If this equipment is chosen by the user, however, he must carry out a pooling process to transfer data to one-half-inch machine-compatible tape. A special pooling device is usually supplied for a minimal monthly rental.

Stand-alones combine to make clusters

The second major equipment category is the multi-keyboard system, such as the Mohawk 9000 series. These systems consist of several keyboard stations, a multiplexer for control of the keyboards and one or two tape units. Each key station has a keyboard and some kind of display console. In these systems, one controller can handle from eight to 128 key stations, and commonly provides program formats for the operator and monitors and directs data accumulation. These systems were introduced in 1968. They are primarily intended for applications where there are large amounts of the same type of data to be keyed. In these applications they can offer economic advantages depending on the number of machines involved.

Since the introduction of the units about three years ago, stand-alone and clustered key-tape devices have evolved into complete data-preparation systems. In these systems, stand-alone work stations are used to capture data as before and to enter it onto one-half-inch magnetic tape. However, added to the system is a central processor (a minicomputer) which contains appropriate programs to edit and validate the tape prior to inputting it to the mainframe computer. These systems, while similar to "key-disk," or "shared-processor" systems (see *Key-disk systems speed mainframe processing off-line,* page 42) differ in that data is not keyed through the central processor. These systems are fairly new on the market: the Data Action 1500 was announced last fall; the Mohawk 2400 only this past February. These systems can offer the user significant advantages, however, by pre-processing tape input, thereby saving considerable mainframe processing time.

Should you use key-tape?

The decision to put in a key-tape system involves comparing the benefits and costs of these systems with other input means, particularly the keypunch. Let's look first at the important advantages of key-tape: A key-tape system becomes profitable once a user gains a production increase of about 15 percent over keypunch machines. The principal reason for increased production is that the key-tape device is electronic, rather than mechanical. Another point should be considered, however: regardless of the device used, an operator's fingers will only move so fast. But key-tape devices allow increases in operator speed by expanding record sizes to more than 80 characters, as required by the keypunch.

Nearly all key-tape machines offer record sizes greater than 80 characters, with some machines offering capacities of up to 720 characters. Some also can "step" through a record format, giving a literal definition of the data field instead of a "field position," as on a keypunch. This eliminates time-consuming operator decisions.

Most time loss in a keying situation comes from "error recovery" or error correction. Both of these are relatively simple and quick with key-tape. When in the "Write" mode, the operator merely backspaces and re-keys the correct character. With the exception of newly announced "buffered" machines, a keypunch error necessitates the re-keying of the entire card.

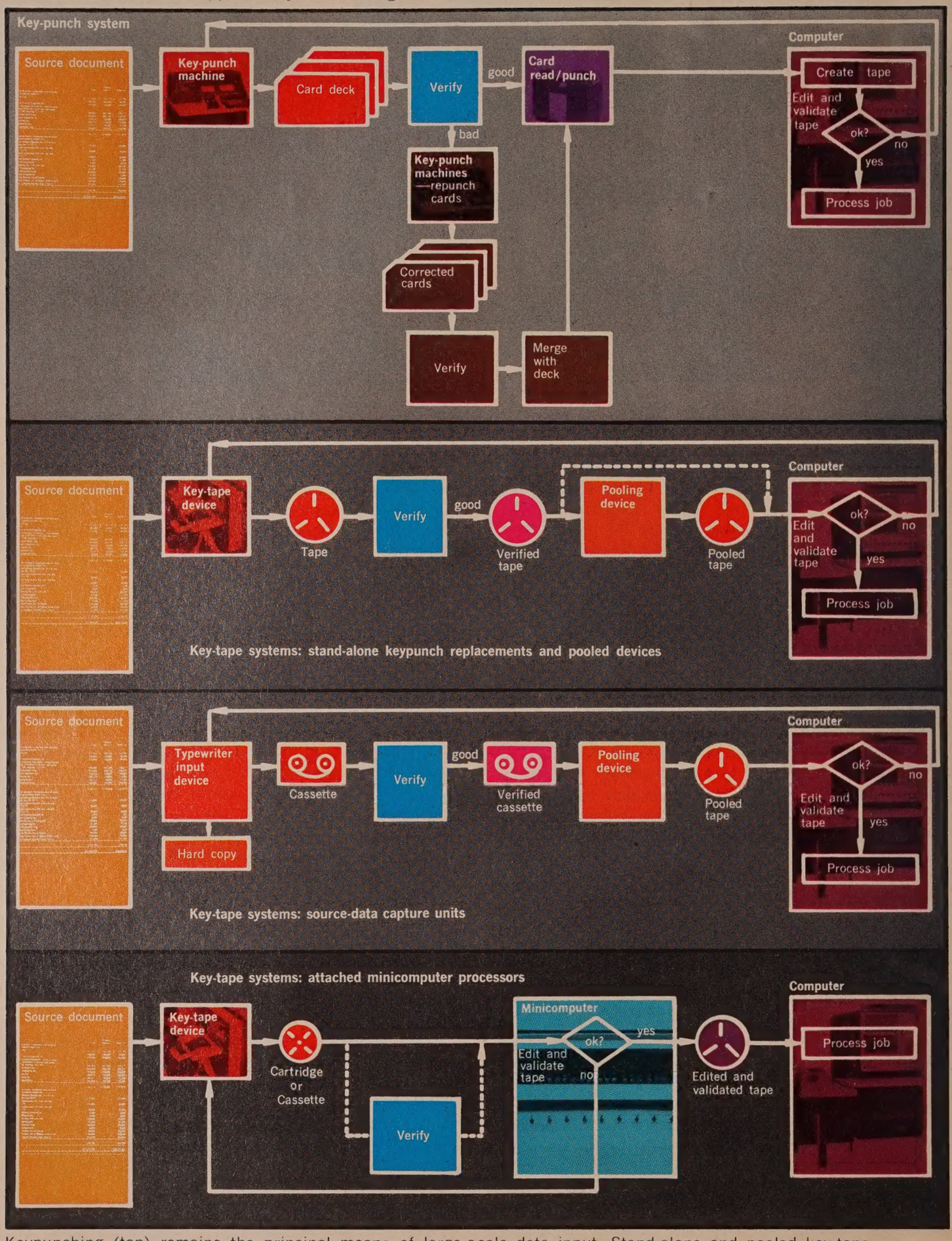
Comparing key-tape and keypunch

The punched card, however, remains the major entry media in data processing, principally because of compatibility with most existing data processing systems. It also has obvious advantages in situations where

Key-tape cuts input costs . . .

(continued)

Typical key-tape and keypunch system configurations



Keypunching (top) remains the principal means of large-scale data input. Stand-alone and pooled key-tape devices, and source-data capture devices (middle) speed input by eliminating many of the cumbersome error procedures associated with keypunching (brown). New key-tape systems with attached minicomputers permit the user to perform editing and validation prior to the mainframe processor run (bottom).

the card itself serves as a working document, for example, in turn-around-document applications such as billing, and in inventory control. Other advantages include the ability to utilize tab equipment as well as the security provided by the user's ability to isolate, hold, read and replace records.

The main disadvantage of punch-card equipment is cost, including costs for ordering, storing and handling cards. The 80-column limitation of the cards forces format compromises which reduce the efficiency of the operator, and a dropped deck can be disastrous. Error correction is cumbersome. Finally, the noise and mechanical nature of the keypunch make working conditions for the operator less than ideal.

Key-tape versus key-disk

The shared-processor or key-disk concept was introduced in 1967. In these systems each key station is tied to a minicomputer which stores the data temporarily on a disk and then dumps the information onto one-half-inch computer tape which is suitable for use as a mainframe input. This approach promotes increased speed and efficiency of handling of all input data through a central controller, without the additional step of handling intermediate magnetic tape as is required on the newer key-tape devices.

The shared-processor concept is most successful in large installations with very high-volume applications—if the user can isolate specific large jobs for his shared-processor installation, significant benefits can be realized. The most obvious limitation lies in the requirement for the minicomputer to do editing and validating while servicing the remote key stations. As a result, each manufacturer makes use of elaborate software to handle necessary data manipulation.

Evaluating your input needs

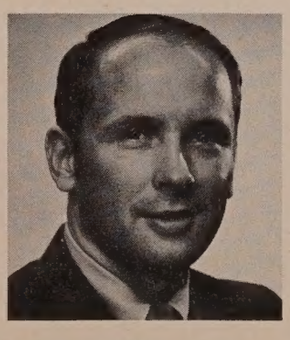
The computer user should evaluate his data preparation methods not only to provide a more efficient and less costly system today, but to provide for orderly growth. Here's one way to approach these evaluations, using a chart with the following columns:

- **Job:** List all of the jobs currently being processed in order of volume, using characters per month as the common measure. The availability and accuracy of this information will be a good indication of the quality of data-preparation control.
- **Volume (char/mo):** For each job, how many characters per month are processed?
- **Information source:** Where does the information to be processed originate? time card, pre-punched, handwritten inquiry, typed form, journal tape, etc.?
- **Computer preparation I:** How is the information prepared for machine reading? keypunch, Flexowriter, key-tape, shared processor, etc.?
- **Computer preparation II:** Where is the information prepared for machine reading? at the source, remote keying pool, local keying pool, etc.?
- **Key verification (percent):** If applicable, what percent of the record is key verified?
- **Maximum record size:** What is the maximum record size (in characters) that can be entered?
- **Batch control:** Is the data currently batched and controlled so that all records must be error free before any information is processed?
- **Current input time:** This is the total elapsed time beginning when the information is under control of the company until processing begins.
- **Desired input time:** Be realistic, obviously it is desirable to have everything done instantaneously.
- **Audit trails:** Are audit trails, such as proof listings, generated to satisfy legal or operational requirements?
- **Processing schedule:** For example: daily, weekly, monthly, annually, etc.

Once the above chart is complete, an objective analysis can be made to determine what input system or systems should be used. In general, the attention should be given to those jobs that cumulatively represent more than 70 percent of the total volume. All time critical jobs should be given special consideration regardless of volume. With these figures in mind, let's see if key-tape is for you.

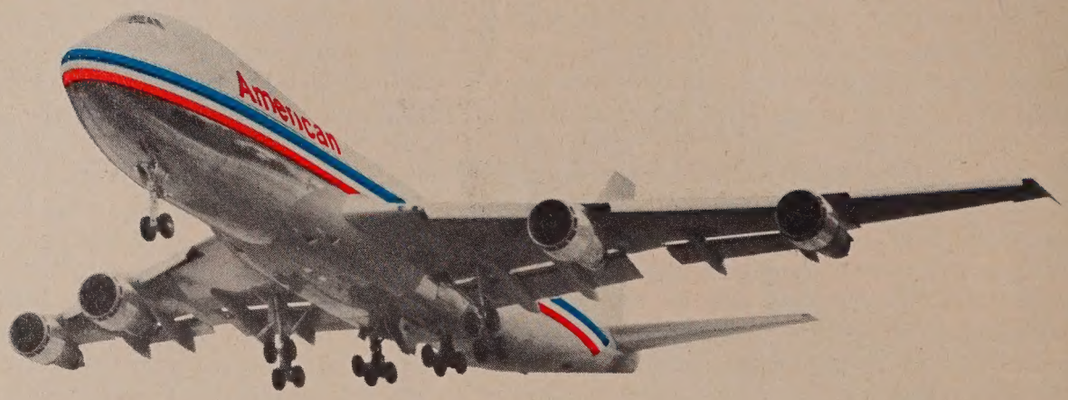
Small user: A user who inputs less than eight-million characters per month (equivalent production of about five keypunches) should give careful consideration to stand-alone key-tape machines, assuming he has a one-half-inch magnetic-tape drive on his system. Under these circumstances, a key-tape device can generally save this user money due to increased operator efficiency. However, if any of the following circumstances exist, the justification for using key-tape machines is greatly increased: a large percentage of data entered is contained in records greater than 80 characters; there are large amounts of data in one job or there is a large number of fields being duplicated and skipped; the information source is a typed document, such as a freight bill; computer preparation is currently being done on a type-to-paper-tape device; computer preparation is remote and time is a factor. In this case key-tape with either a typewriter or keypunch keyboard should be considered.

Medium and large users: Users that input more than eight-million characters per month (equivalent production of five keypunches) should not only consider the use of key-tape devices for recording data either in a central pool or remotely, but they should also consider off-line data-preparation systems being offered with editing and validating features, such as the Mohawk 2400 or the Data Action 1500. With these systems, significant savings may be realized if there is a high percentage of key verification since errors can be detected by an edit program, thereby making key verification unnecessary. A second advantage accrues when audit trails are required as a part of data preparation —they may be generated on the system. Finally, key-tape systems are particularly suited to a growth situation—the user may start small and increase proportionately to volume. □



One of the founders of Data Action Corp., Jim Bauch heads up the company's marketing operations. His computer experience includes work as systems manager at Cognitronics Corp., and four years with Control Data where he was responsible for the development of the 915 page reader.

a change is coming in communications-based computer systems



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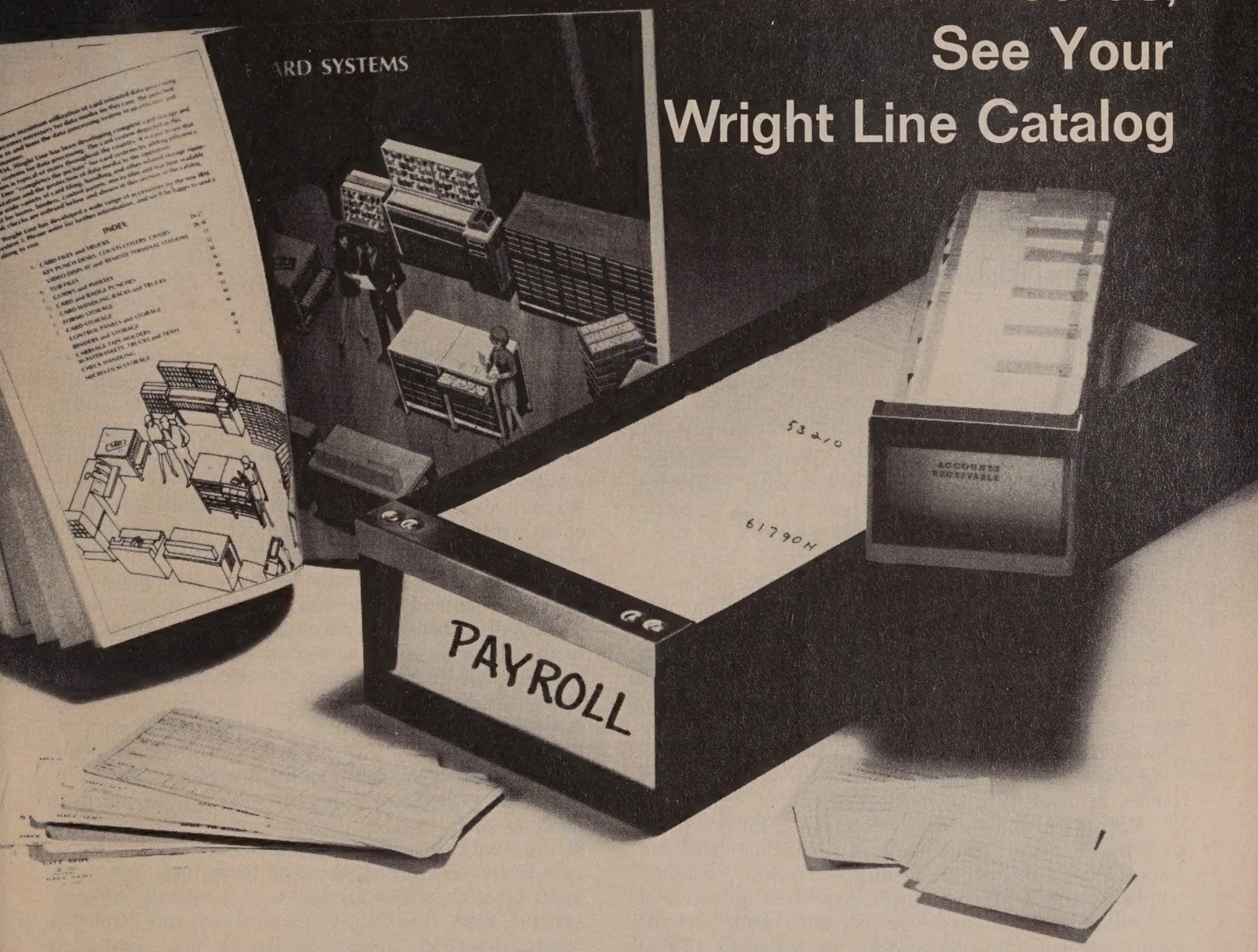

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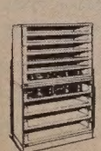
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Key-disk systems speed mainframe processing off-line

These data-input systems are expensive, but they can save the user considerable mainframe processor time

by Barry M. Harder
Entrex, Inc.
Lexington, Mass.

By putting a minicomputer in charge of several keyboard workstations, users can record large quantities of ready-to-process source data onto a single magnetic tape without the expensive and time-consuming mainframe validation and editing runs normally associated with large-scale input jobs. With these shared-processor, or "key-disk" systems, users can substantially increase the throughput on their mainframe computers, eliminate the maintenance and support of the utility programs formerly needed to perform these editing and validation jobs, and dedicate the main storage and peripheral devices needed for these jobs to other, more productive tasks. However, these systems can be expensive, costing about $200 per terminal per month, or about three times as much as a keypunch machine.

Key-disk systems were developed in 1967 as a result of the low-cost availability of minicomputers and associated disk- or drum-storage devices. Basically, these systems are built around a number of independent keyboard workstations where the source data is physically entered into the system by operators. These workstations also have some form of data display—ranging from a full-tube crt to a single-character display—for the operator's benefit. Actual editing and validation of the source-data input is handled by the system's central processor, a minicomputer with from 4k to 128k bytes of core storage, depending on the number of workstations, with an attached direct-access device (disk or drum) with from 0.4-million to more than 11-million bytes of capacity for intermediate storage of keyed data. The size of this device is also a function of the number of workstations within the system, and also on the lengths of records being handled and on other factors such as the number of different record formats which are stored. Finally, these systems contain facilities for outputting the edited and validated source data onto a magnetic tape which is then ready for the mainframe-processor run.

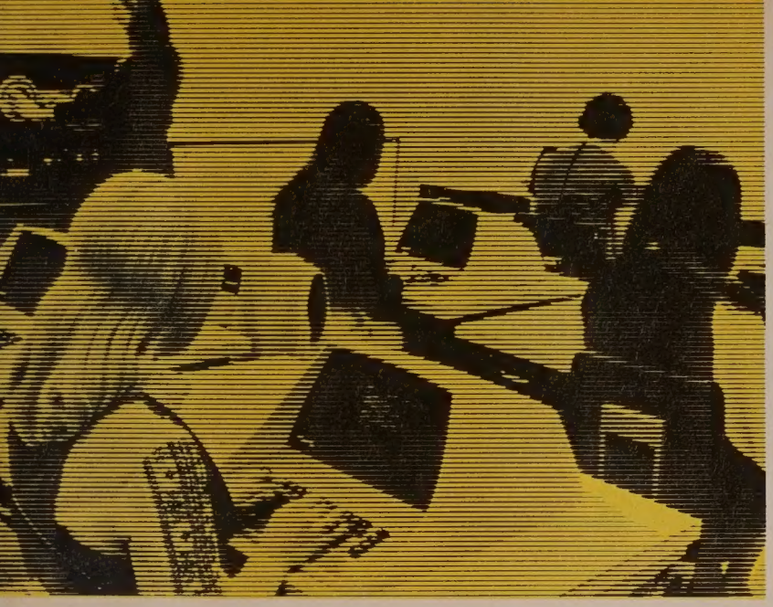
In operation, data from source documents is keyed into the system by the operators at the workstations, through the central minicomputer processor and onto the attached disk. The records are held there until verified by the operator—either visually (using the crt or single-character display), by re-keying (in a manner similar to a keypunch), or through a combination of both. As part of the input process, the minicomputer validates the data and edits it as required and as the data is entered. Some of the validation procedures which can be performed by typical key-disk systems include:

- check digits, which are used principally to insure correct numeric input. For example, in a seven-digit identification number, the last digit could be the "check digit" and could be arrived at by a combination of multiplication and addition of the preceeding six digits. The result is checked by the computer. If it corresponds to the check digit, the numeric data is accurate. This tends to eliminate the major numeric-data entry problem—transposed digits;
- high-, low-range checking of a numeric value;
- "must-enter" fields to prevent inadvertent skipping of fields—for example a customer's account number;
- boundary-checking, to prevent overflow into the next field;
- alpha-only or numeric-only checks.

In addition to allowing the user to perform these and many other checks on his data as it is entered, key-disk systems allow searching of files to find and display a record, insertion of records into a file—similar to adding new punched cards, merging of records into new batches (for example, employees formerly listed under two departments are now listed under one department) and the merging of batches into new files.

Key-disk in operation

Let's see how this works: If the records processed by the mainframe were specified as 80-column records (keypunched then put on tape for later validation and editing prior to processing), the user with a key-disk system simply keeps going the way he always has—except for one difference: operator efficiency is noticeably increased since she continuously keys source data from top to bottom, regardless of the format demanded by the punched card. The programs contained in the minicomputer then edit this input into 80-column records, validate the data and prepare a final tape. To the mainframe software, nothing has changed—the input is the same as it always has been. In effect, then, key-disk machines present the user two opportunities: first, he can input data in a form which is convenient to the mainframe; second, he can if needed, permit input in a form which is more productive and convenient



to the operator, as mentioned above. In addition, variable length source documents can be formatted to any required length, without any intervention on the part of the operator. In both cases, the "translation" to the format used by the mainframe is accomplished by the software supplied by the manufacturer of the minicomputer within the key-disk systems.

Keystations: some display data; some don't

In keypunching, a card containing an error can be seen by the operator, and can be removed. In key-disk systems, however, the operator can no longer touch the record—she must be given both a method of determining where she is in a record or batch, and a means of correcting mistakes, verifying and editing. To provide her with a means of interacting with the system, a form of display is provided on all systems. One effective way of accomplishing this interaction is via a crt display at the keystation such as offered on the Entrex 480 and the Inforex systems. This permits viewing of the entire record being entered or verified in context, and with backspace/strikeover capability permits easy correction of mistakes as they occur. Use of a crt can also speed verifying. For example, verification can be done visually or by entirely re-keying the data, or by any combination of visual and key verification. Other manufacturers (see survey, p. 46), however, offer "blind" entry stations—limited data displays which interpret what the operator needs to know through coded indicators.

Interaction with systems using this method—such as the Computer Machinery Corp. KeyProcessing system, Redcor's Key-Logic and Consolidated Computer's Key-Edit—is accomplished via an array of keys or switches. While this approach has the advantage of producing lower hardware costs, it can lead to more complicated training programs for the operators, and may promote a higher probability of keying errors.

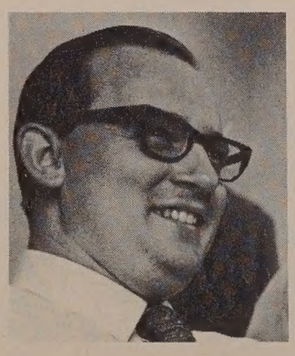
The software necessary to perform all these functions, as well as that necessary to edit and validate all input data and to physically transfer this data to the final output tape comes with the system—key-disk manufacturers are normally "bundled." This software, of course, should be configured as closely as possible to the exact needs of the user. For example, whether or not programs to handle one type of validation or edit check are included is a function of whether or not they are required as indicated by the application source document. In short, if the source document has no alpha information on it, then you had best make sure your programs have the capacity to check for alpha characters which may inadvertently be keyed in. Options to the software generally supplied by the manufacturers include those programs which will extend editing and validation procedures beyond those normally supplied—for example, supplying two check digits instead of one.

Key-disk and other input media

Keypunch machines, of course, are still the major means of converting source data to machine-readable form. However, these machines have obvious limitations. First and foremost, record size is limited by the physical size of the punched card itself; operator efficiency is lower due to the time interval between cards, and errors are costly and hard to correct. Key-disk systems offer users a way to get around these problems. The trade-off, of course, is total cost versus throughput. Key-disk systems rent for considerably more than comparable keypunch machines—for a 10-station system, the average cost may be in the neighborhood of $200-250 per month per station, compared to $125 per month for IBM's latest buffered keypunch. Standard 029 keypunches rent for even less. These cost figures come down as the number of stations increases—for 25 stations, the average cost can be reduced to about $175. However, key-disk systems can, and have, increased throughput 25 to 75 percent, depending on the application.

Key-disk or key-tape

Key-disk systems can offer significant advantages over key-tape devices: increased speed and efficiency is promoted in the input process since all input goes directly through the central processor in the system—an approach which eliminates the need to either "pool" the tape from a series of stand-alone key-tape units or to physically transfer it to a system processor for editing and validation before running it through the mainframe. Against these advantages, the user must once again weigh cost per terminal and must contend with scheduling problems if disk capacity is exceeded. Possible downtime of the system should also be considered by those contemplating key-disk systems. Mostly, these will occur in the mechanical parts of the systems such as the tape-handling equipment, and disk rather than the system's central processor. In this case, the user should make sure that his system is capable of inputting directly to the main processor and bypassing either the tape, the disk or the minicomputer if either should be down. □



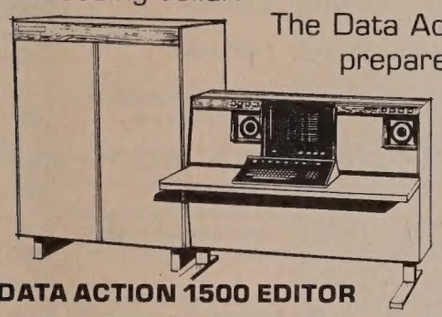
Entrex president Barry Harder's computer credentials go back to University of California, Berkeley—while he was studying for his master's, he founded the West Coast's first computer dating service, Computer Date Company. Prior to founding Entrex with other associates, he studied at MIT's Man-Machine Systems Laboratory and did consulting work.

DATA ACTION CHALLENGE

WE CAN SOLVE MORE OF YOUR INPUT COST PROBLEMS BETTER THAN ANYBODY CAN!

Data preparation is our business: finding easier, faster, more accurate ways to do it.

Every person at Data Action is committed to computer input—with one goal—to cut your input costs. We make our living doing it. And we do it with a system approach that can save you, in hard dollars, up to 50% of your total data preparation cost—and as much as 30% of your total data processing dollar.



DATA ACTION 1500 EDITOR

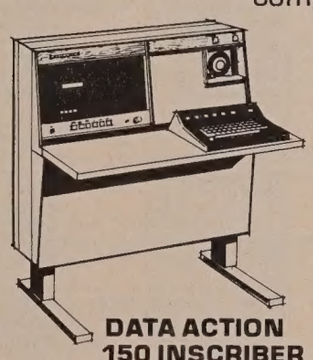
The Data Action system prepares information for your computer—from the time your source document is created until you address your master file.

The system gives you faster, simpler data preparation. It can eliminate pre-processing runs on your computer. You make one trip to your computer room with completely accurate information.

Two Data Action entry units are available with the system: The 150 Magnetic Data Inscriber and the 220 Typescribe. Choose the one best suited for your requirements.

The 150 Inscriber is a key-to-tape entry unit for use in a central data preparation location. It operates like the keypunch, but without its mechanical limitations. The operator can work faster and more efficiently.

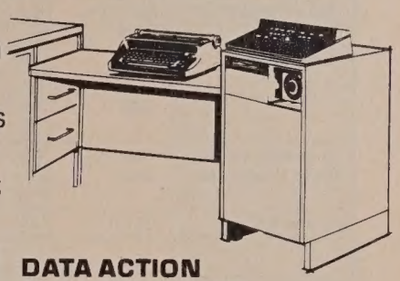
The Data Action Typescribe captures data on magnetic tape at its source. Any typist can use it. It employs a standard IBM Selectric typewriter.



DATA ACTION 150 INSCRIBER

Data is recorded on tape as the operator types hard copy. The Typescribe eliminates two costly, slow steps in standard data preparation: keypunching and key verifying.

Data keyed on the 150 Inscriber and the 220 Typescribe (as well as the IBM MT/ST) can then be processed by the 1500 Data Editor. The Editor handles editing of input data automatically, to your criteria. It puts data into final computer-ready form. It eliminates expensive pre-processing runs on your mainframe and eliminates costly machines and operators for entering verified input data.



DATA ACTION 220 TYPESCRIBE

The ability to perform conditional verification adds to the unique advantages of the Data Action system approach. You eliminate up to 100% of key verification.

The Data Action input system also makes available a tape unit for output on 7 or 9 track compatible tape in all densities (including 1600 BPI)—and a full line of printers from 300 to 1200 lines per minute.

We believe we can solve more of your input cost problems better than anybody else. Why not make us prove it?

Contact your nearest Data Action Sales Office. Or write; DATA ACTION, Dept. A3071, 4445 West 77th St., Minneapolis, Minn. 55435 Phone 612/920-9200.

DATA ACTION
THE INPUT COMPANY

INFORMATION RETRIEVAL NUMBER 299

Key-Tape Devices Can Cut Input Costs

Company Name	Model	Type	Key-board	Tape	Formats	Edit Checks	Verifi-cation	Tape Codes	Max. Record Length	Price/Delivery	Comments	Info. Ret. No.
Addressograph-Multigraph Corp.	6000 Series	Pooled	K/P	1/2-in. MT	2	Check digit, accumulator	Cross verifi-cation	BCD, EBCDIC	500 chars.	$16,200/30 days; $180/month	Price is for two key stations; 7-, 9-track versions available	251
Burroughs Corp.	N7200/7500, N9800	SA	T/W	1/2-in. MT	2	Check digit	Sight	BCD, EBCDIC, ASCII	160 chars.	$36,455/immed.; $807/month	Price if for 9-track 9800; 7200, 7500 are 7-track devices	252
Cogar Corp.	System 4	SA	K/P, T/W	Car.	Un-limited	Check digit, batch balance	Sight, re-key	BCD, EBCDIC, ASCII	120 chars.	$6,000/one month; $135/month	Contains 2 - 16k memory and crt display	253
Communitype Corp.	100 Series	SA	T/W	Car.	None	None	Sight	BCD	Un-limited	$11,600/30 days; $340/month	Model 105 with memory costs $14,000; $370/month	254
Compat Corp.	Comfile 88-23	SA	T/W	Maga-zine	Un-limited	Check digit	Re-key	BCD, EBCDIC	64k chars.	$12,600/90 days; $315/month	7-, 9-track models available	255
Computer Terminal Corp.	Datapoint 2200	SA, pooled	T/W	Cas., 1/2-in. MT	Un-limited	Check digit, batch balance	Sight, re-key	BCD, EBCDIC, ASCII	Un-limited	$5,500-7,800/3-6 months; $180-225/ month	8k computer and program contained in terminal	295
Cybercom Corp.	Mark I	SA	K/P	Cas.	7	Check digit	Re-key	BCD, EBCDIC	120 chars.	$18,450/30 days; $145/month		256
Data Action Corp.	150 Inscriber	SA	K/P	Car.	8	Alpha/numeric	Re-key	EBCDIC	720 chars.	$7,000/45 days; $135/month		257
	220 Trans-scribe	SA	T/W	Car.	Un-limited	None	Sight	Spec.	25,000 chars.	$3,700/45 days; $75/month		258
	1500	SA	K/P	Car., 1/2-in. MT	8	Check digit, batch balance, cond. verification	Sight, re-key	BCD, EBCDIC, ASCII	720 chars.	$80,000/45 days; $1,600/month	System uses mini for edit and validation of output tape	259
Data Instrument Co.	Dataplex	SA	T/W	Cas.	None	None	Sight	ASCII	80 chars.	$2,850/90 days; $84/month	Output tape edited by the Dataplex processor	260
Digital Information Devices, Inc.	Data Tran-scriber	SA	K/P	1/2-in. MT	2	None	Re-key	BCD, EBCDIC	100 chars.	$8,000/30-60 days; $160/month	7-, 9-track models available	261
Facit-Odhner	6202	SA	T/W	1/2-in. MT	None	None	Sight	BCD	Un-limited	$3,575/30-90 days; $145/month	7-track device	262
	6005	SA	A/M	1/2-in. MT	Un-limited	Batch total	Sight	BCD	Un-limited	$4,445/30-60 days; $170/month	7-track device	263
Honeywell Infor-mation Systems, Inc.	700/900 Series	SA	K/P	1/2-in. MT	2	Alpha/numeric	Re-key	BCD, EBCDIC, ASCII	400 chars.	$8,250-$37,450/ 30-120 days; $165-$780/month	Price is for 9-track 900; 700 is a 7-track unit	264
Hypertech Corp.	GTU-1	SA	T/W	Cas.	300	None	Re-key	BCD, EBCDIC, ASCII	100 chars.	$5,000/30 days; $75/month		265
IBM Corp.	IBM 50 Mag-netic Data Transcriber	SA	K/P	Car.	8	Check digit, record counter	Re-key	EBCDIC	720 chars.	$9,605/six months; $175/month	Operates with IBM 2495 reader	266
International Data Sciences, Inc.	Libra I	SA	K/P	1/2-in. MT	2	Check digit, batch balance	Re-key	BCD, EBCDIC, ASCII	160 chars.	$8,250/90 days; no monthly rentals	7- and 9-track versions available. OEM only	267
Keymatic Data Systems	1073/1093	SA	T/W	1/2-in. MT	None	None	None	BCD, EBCDIC	Un-limited	$9,570/60-90 days; $368/month	Price is for 9-track 1093; 1073 is a 7-track unit	268
	K-103	SA, pooled	T/W	Cas.	None	None	None	EBCDIC	Un-limited	$7,500/60-90 days; $217/month		269
MAI Equipment Corp.	100 Series	SA	K/P	Car.	2	Check digit, batch balance	Re-key	BCD, EBCDIC	200 chars.	$6,400/60 days; $160/month	Price is for 9-track Model 2; Model 1 is a 7-track unit	270
Mohawk Data Sciences Inc.	1100/6400	SA	K/P	1/2-in. MT	2	Check digit	Re-key	BCD, EBCDIC	180 chars.	$8,000/6-12 weeks; $169/month	Price is for 9-track 6400; 1100 is a 7-track unit. Over 40 models avail. in these lines	271
	2400	Pooled	K/P	1/2-in. MT	10	Check digit, zero balance, batch balance	Re-key	BCD, EBCDIC, ASCII	190 chars.	$700-2900/month; deliveries begin in July	Minicomputer used for edit and validation	272
	9000	Pooled	K/P	1/2-in.	10	Check digit, zero balance	Re-key	BCD, EBCDIC, ASCII	190 chars.	$31,600/12 weeks; $790/month	Price is for 8 key stations, 1 controller, 1 tape drive	273
MSI Data Corp.	Source 2000	SA	T/W	Cas.	None	None	Sight	ASCII	Un-limited	$1,135/30-60 days; no monthly rental	2001 is a numeric only device; 2002 is alpha/numeric	274
National Cash Register Co.	735/736	SA	K/P	1/2-in. MT	2	None	Re-key	BCD, EBCDIC, ASCII	180 chars.	$8,000/60-90 days; $169/month	Price is for 9-track 736; 735 is a 7-track unit	275
Novar Corp.	550	SA	T/W	Car.	None	None	Sight	BCD	360 chars.	$6,715/30 days; $195/month	Includes built-in modem	276
Potter Instrument Co.	3000 Series/ 4100	SA	K/P	1/2-in. MT	2	None	Sight, re-key	BCD, EBCDIC, ASCII	160 chars.	$8,100/6-8 months; $165/month	Price is for 9-track 4100; 3000 series are 7-track units	277
Sanders Associates, Inc.	System 6000	SA, pooled	K/P, T/W	1/2-in. MT	Un-limited	None	Re-key	BCD, EBCDIC	1,024 chars.	$22,618/90 days; $597/month	7-, 9-track versions available; price includes 1 terminal, 1 tape recorder	278
Sangamo Electric Co.	7100/9100	SA	K/P	1/2-in. MT	2	None	Sight, re-key	BCD, EBCDIC	240 chars.	$8,200/60-90 days; $177/month	Price is for 9-track 9100; 7100 is a 7-track device	279
Singer/Friden	4300 Series	SA	K/P	1/2-in. MT	2	Alpha/numeric	Re-key	EBCDIC, ASCII	200 chars.	Approx. $4,500/90 days; $180/month	Several models available	280
Sycor, Inc.	340 Com-munications Terminal	SA	T/W	Cas.	Un-limited	Check digit, batch balance	Sight, re-key	BCD, EBCDIC, ASCII	256 chars.	$6,600/60 days; $150/month	Pooled via the 610 communications station	281
Tally Corp.	Datascribe	SA, pooled	K/P	1/2-in. MT	3	Read after write	Re-key	BCD, EBCDIC, ASCII	200 chars.	$8,060/30-60 days; $175/month	7-, 9-track versions available	282
Ty-Data, Inc.	8500	SA	K/P	Cas.	1,000	None	Re-key	ASCII	240 chars.	$5,000/30-60 days; $105/month		283

Key-Disk Systems Can Speed Computer Processing

Company Name	Model Name	No. of Stations (Min/Max)	Key-board	CRT Display		Central Processor		Intermediate Storage		Price/Delivery	Basic Configuration	Info. Ret. No.
				No. of Charac-ters	Cursor Control	Name/Capacity	Pro-grammed By Mfr.	Type/ Number	Capacity (Bytes)			
Applications Unlimited	AU100	1/32	K/P, T/W	No crt	NA	A101, A102, A103/20k	Yes	Disk, mag tape/1	256k - 512k (disk), 18 million (tape)	$125,000/60 days; $2,500/month	16 key stations	284
Computer Machinery Corp.	Key Processing Systems	1/32	K/P	No crt	NA	PDP-8/E/32k	Yes	Disk/1	7.25 million	$45,200/4 months; $1,130/month	8 key stations	285
Consolidated Computer International, Inc.	Key-Edit	4/32	K/P	No crt	NA	PDP-8/I/32k	Yes	Drum/1	5600k	$51,000/60 days; $975/month	4 key stations	286
Entrex, Inc.	System 480	8/64	K/P, T/W	480	Yes	Nova/64k	Yes	Disk/1-4	10 million	$83,175/30 days, $1,997/month	8 key stations	287
Four-Phase Systems, Inc.	System IV/ 70	1/32	T/W	1152	Yes	Four-Phase 7001/24k	No	Disk/1-4	2.5 million	$70,800/8 weeks; $1,736/month	24 key stations	288
General Computer Systems, Inc.	System 2100	1/31	K/P, T/W	512	Yes	CAI 216/64k	No	Disk/1-4	9 million	Not for sale $3,010/month 60-90 days	20 key stations	289
Honeywell Information Systems, Inc.	Keyplex/ 5500	10/64	K/P	No crt	NA	Honeywell 316/64k	Yes	Disk/1	7.25 million	$108,000/120 days; $2,250/month	10 key stations	290
Inforex, Inc.	Intelligent Key-Entry System	1/8	K/P	128	No	Inforex/8k	Yes	Disk/1	900,000	$35,100/90 days; $960/month	8 key stations	291
Logic Corp.	LC 720	10/60	K/P	240	Yes	Varian 620/i/ 65k	Yes	Disk/1-4	7.25 million	$187,400/90-120 days; $4,000/month	25 key stations	292
Mark Computer Systems, Inc.	System 70	1/64	K/P	256	Yes	Nova, Supernova/16k	Yes	Disk/2	1 million	$129,000/90 days; $3,000/month	12 key stations	293
Redcor Corp.	KeyLogic	5/40	K/P	No crt	NA	RC-70/32k	Yes	Disk/1	2 million	$88,000/30 days; $1,800/month	No terminals; purchase price per terminal: $3,200; $75/mo. rental	294

SA = Stand alone *T/W = Typewriter* *MT = Magnetic tape* *Cas. = Cassette* *Spec. = Special*
K/P = Keypunch *A/M = Adding machine* *Car. = Cartridge* *Chars. = Characters* *NA = Not applicable*

Key-Tape, Key-Disk Manufacturers

Addressograph-Multigraph Corp.
1200 Babbitt Rd., Cleveland, Ohio 44117
(216) 731-8000 *(Key-tape)*

Applications Unlimited, Inc.
2820 Dorr Ave., Fairfax, Va. 22030
(703) 573-7200 *(Key-disk)*

Burroughs Corp.
2nd Ave. at Burroughs, Detroit, Mich. 48232
(313) 972-7000 *(Key-tape)*

Cogar Corp.
P.O. #110, Herkimer, N.Y. 13350
(315) 866-3040 *(Key-tape)*

Communitype Corp.
767 5th Ave., New York, N.Y. 10022
(212) 758-4230 *(Key-tape)*

Compat Corp.
177 Cantiague Rock Rd., Westbury, N.Y. 11590
(516) 822-1320 *(Key-tape)*

Computer Machinery Corp.
2231 S. Barrington Ave., Los Angeles, Calif. 90064
(213) 477-1585 *(Key-disk)*

Computer Terminal Corp.
9725 Datapoint Drive, San Antonio, Tex. 78229
(512) 696-4520 *(Key-tape)*

Consolidated Computer International, Inc.
235 Wyman St., Waltham, Mass. 02154
(617) 891-7100 *(Key-disk)*

Cybercom Corp.
432 Toyama Dr., Sunnyvale, Calif. 94086
(408) 734-3230 *(Key-tape)*

Bata Action Corp.
4495 W. 77th St., Minneapolis, Minn. 55435
(612) 920-9200 *(Key-tape)*

Data Instrument Co.
16611 Roscoe St., Sepulveda, Calif. 91343
(213) 893-6464 *(Key-tape)*

Digital Information Devices
210 Welsh Pool Rd., Lionville, Pa. 19353
(215) 647-3700 *(Key-tape)*

Entrex, Inc.
168 Middlesex Tpke., Burlington, Mass. 01803
(617) 273-0480 *(Key-disk)*

Facit-Odhner
501 Windsor Dr., Secaucus, N.J. 07094
(201) 866-5111 *(Key-tape)*

Four-Phase Systems, Inc.
10420 N. Tantau Ave., Cupertino, Calif. 95014
(408) 255-0900 *(Key-disk)*

General Computer Systems, Inc.
12011 Coit Rd., Dallas, Tex. 75230
(214) 239-0375 *(Key-disk)*

Honeywell Information Systems, Inc.
7630 Convoy Ct., San Diego, Calif. 92112
(714) 279-9000 *(Key-tape)*

Honeywell Information Systems, Inc.
8611 Balboa Ave., San Diego, Calif. 92112
(714) 277-6590 *(Key-disk)*

Hypertech Corp.
7343 W. Wilson Ave., Harwood Heights, Ill. 60656
(312) 867-4200 *(Key-tape)*

IBM Corp., Data Processing Div.
1133 Westchester Ave., White Plains, N.Y. 10604
(914) 696-1900 *(Key-tape)*

International Data Systems, Inc.
110 Nashua St., Providence, R.I. 02904
(401) 274-5100 *(Key-tape)*

Inforex, Inc.
21 North Ave., Burlington, Mass. 01803
(617) 272-6470 *(Key-disk)*

Keymatic Data Systems Corp.
56 Penataquit Ave., Bay Shore, N.Y. 11706
(516) 666-4008 *(Key-tape)*

Logic Corp.
21 Olney Ave., Cherry Hill, N.J. 08034
(609) 424-3150 *(Key-disk)*

MAI Equipment Corp.
300 E. 44th St., New York, N.Y. 10017
(212) 557-3500 *(Key-tape)*

Mark Computer Systems, Inc.
1 Patterson Pl., Garden City, N.Y. 11530
(516) 746-5885 *(Key-disk)*

Mohawk Data Sciences Corp.
P.O. #630, Herkimer, N.Y. 13350
(315) 867-6000 *(Key-tape)*

MSI Data Corp.
4751 Holt Ave., Montclair, Calif. 91763
(714) 626-2451 *(Key-tape)*

National Cash Register Co.
Main & K Sts., Dayton, Ohio 45409
(513) 449-2000 *(Key-tape)*

Nova Corp.
2370 Charleston Rd., Mountain View, Calif. 94060
(415) 934-3900 *(Key-tape)*

Potter Instrument Co.
151 Sunnyside Blvd., Plainview, N.Y. 11803
(516) 694-9000 *(Key-tape)*

Redcor Corp.
7800 Deering Ave., Canoga Park, Calif. 91304
(213) 348-5892 *(Key-disk)*

Sanders Associates, Inc.
Daniel Webster Hgwy, Nashua, N.H. 03060
(603) 885-4211 *(Key-tape)*

Sangamo Electric Co.
P.O. #7255, Denver, Colo. 80207
(303) 399-2263 *(Key-tape)*

Singer Co., Friden Div.
2350 Washington Ave., San Leandro, Calif. 94577
(415) 357-6200 *(Key-tape)*

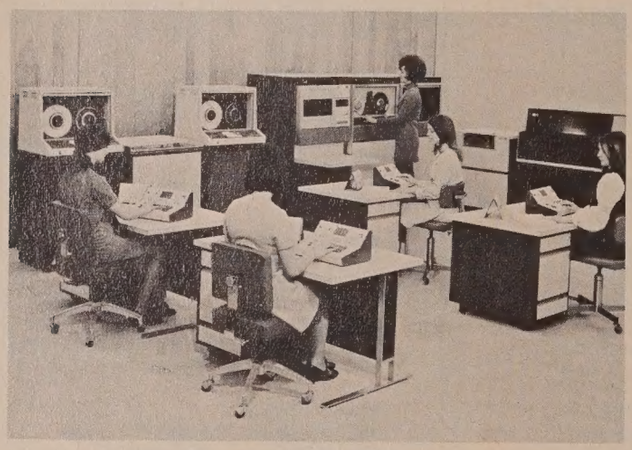
Sycor, Inc.
100 Phoenix Dr., Ann Arbor, Mich. 48104
(313) 971-0900 *(Key-tape)*

Tally Corp.
8301 S. 180th St., Kent, Wash. 98031
(206) 251-5660 *(Key-tape)*

Ty-Data, Inc.
109 Northeastern Blvd., Nashua, N.H. 03060
(603) 889-1155 *(Key-tape)*

The Peripheral Processor.

Put most simply, the new MDS SYSTEM 2400 gives you greater I/O services. It's something like a maxi-channel, and something like a mini-computer. Except that it does more, and costs less, than either. That's because we make all the elements that go into it.



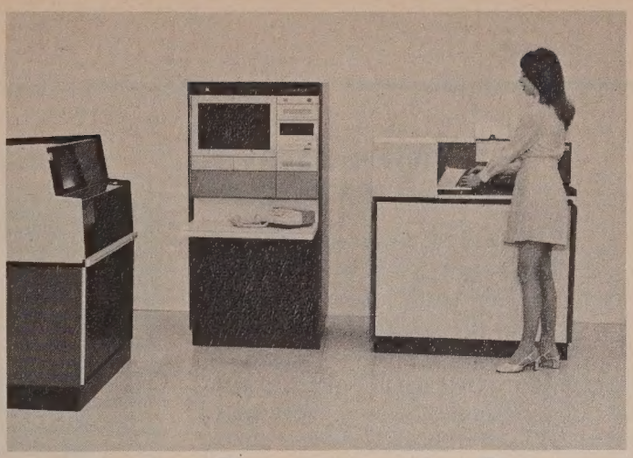
Data-Editor

The heart of the system is the new 2405 Processor.
With up to 32 K bytes available, it can take quite a load off your main frame's shoulders. And we have a new language to run the system—a language that anybody in the world can learn in three days. That should take quite a load off your programming shoulders, too.

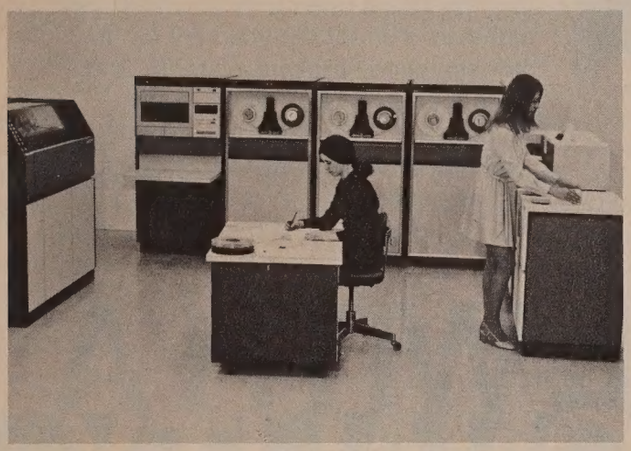
Configure it yourself. Because it's modular, the 2400 can be dedicated to do your specific jobs, in a cost range starting at $600.
In its expanded configuration the 2400 edits input, edits output, sorts and merges magnetic tape, reformats and prints, commits reference data to disc, and gives you high speed BSC data transmission.

Data-Printer

As an editor, the 2400 will take raw keyboard data and rearrange, reformat, perform any kind of validity checking, range testing, sequence checking, and conditional value testing. It will pool or merge data from various keyboards or from different media. It will select and sort the records needed for a particular run. It will produce one edited reel of magnetic tape ready for processing.



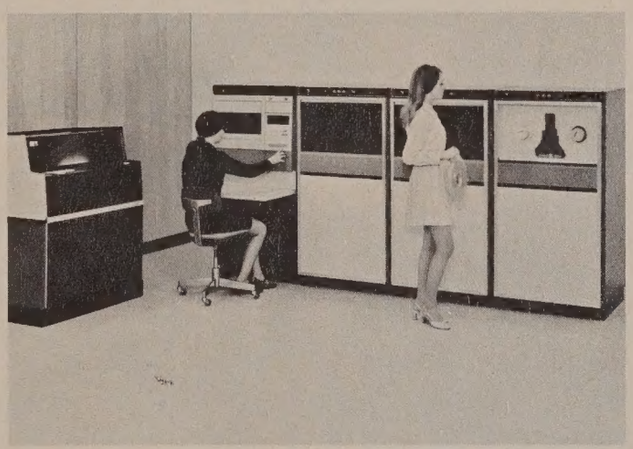
Data-Communicator



Data-Converter

As a communications terminal, the 2400 can take a tape that wasn't originally edited for communications and transmit it in compressed, control-coded format. It can convert data received in any code or format, and it will translate, reformat, and output data any way you want. The 2400 can go from any one medium to any medium or mediums your computer prefers.

As a converter, the 2400 can covert from cards, mag tape, paper tape, communications, and keyboard—to cards, mag tape, paper tape, communications, and line printing.
The 2400 can, in fact, satisfy all your utility needs with off-line simplicity. It's our new generation of peripheral control, timed to meet the newest generation of computer equipment.

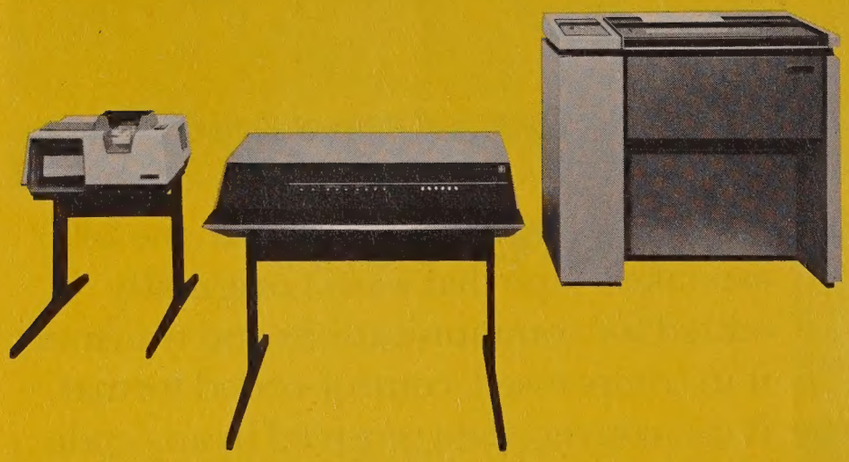


Data-Sorter/Collator

Mohawk Data Sciences Corp.
Herkimer, New York

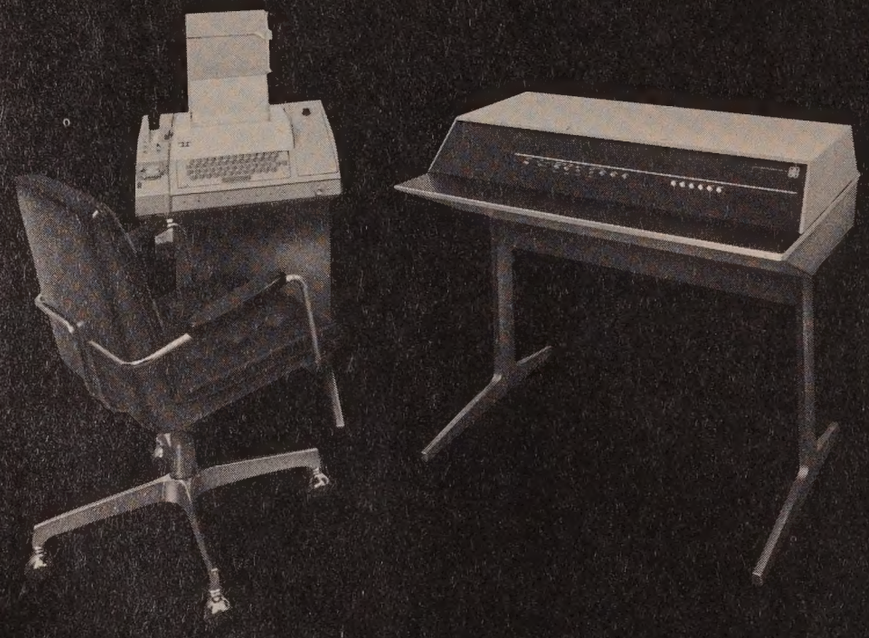
MDS

Mohawk Data's System 2400. Peripherals come of age.



Imagine a terminal that speaks all languages and can communicate and trade data with every major time sharing computer. One that can be implemented with HASP multi-leaving software to double your through-put. Line rates from 2000 Bits/Sec over dial-up to 50K B/Sec over dedicated lines. A host of sophisticated handling techniques. Modular hardware construction. A monthly rental rate starting at $490. per month as a direct replacement for the old-fashioned hardwire systems. And, you begin to realize that the M&M Remote Batch Terminal has a degree of intelligence which can only be classified as genius.

TERMINAL WITH A DUAL PERSONALITY



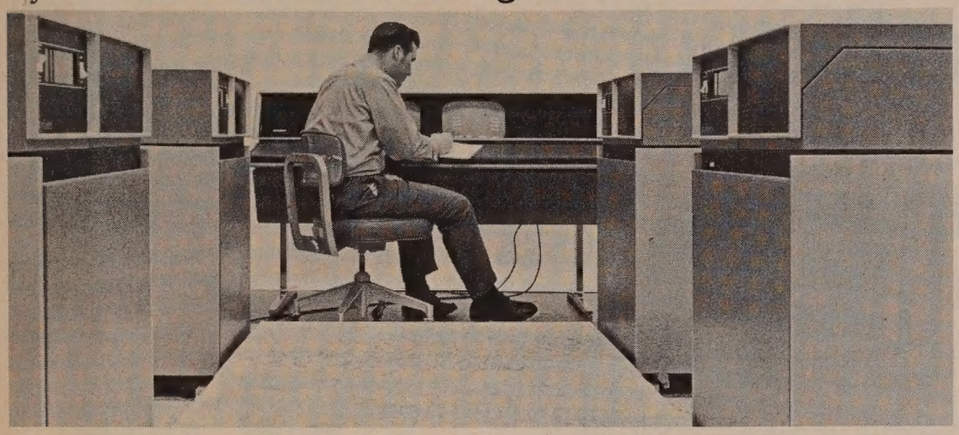
But, even more than that, its skills also include the capability to operate as a small general purpose computer without impairing the terminal functions. This means you can perform many preliminary calculations, develop models, check out software, create new programs and operate sub-routines without bothering the main central processor. FORTRAN IV, ALGOL 60, Time Sharing Basic, Disc Operating System, Single User Basic, Standard Assembler, Relocatable Assembler, Character Text Editor, Symbolic Debugger, math routines, Floating-Point and Diagnostic are but a part of its present user software library.

Call now or write for details on this prodigy of prodigies.

M&M COMPUTER INDUSTRIES, INC.
770 North Main Street, Orange, California 92668
(714) 639-1134

INFORMATION RETRIEVAL NUMBER 17

System stores and retrieves large files of documents



Combining video recording and computer disk storage, the "CMX 600" system can store tens of thousands of document images. Retrieval of a document image takes place in less than 70 milliseconds. The system records both audio and visual data, and the documents may be either alphanumeric or graphic. By means of a special scan conversion unit, direct digital transmission can be accepted and transferred to the disk drives for storage and display. A typical system including editing and display console with light pen control, control processor, and working storage disk drives capable of storing approximately 100k documents costs $277,000 and is delivered within four months.

CMX Systems, 635 Vaqueros Ave., Sunnyvale, CA 94086. (408) 245-8450.

CIRCLE NO. 351

Key-tape system replaces key punches

Designed to replace keypunch machines for preparing data for processing, the Model 85 Key-Edit system comprises a 12k central processor, seven- or nine-track magnetic-tape drive, fixed-head drum, supervisory control console and from 20 to 32 keystations. The standard operating system for the Model 85 includes program loading, error recovery and restart, and drum dump, load, and initialize. Standard record length is 80 characters. Supervisory control functions are load, stop, position peel tape, list, peel, release, peel and release protect, summary, stop, status of storage drum, and timed operator statistics.

The Model 85 Key-Edit system is leased at $2,000 a month for the 20 keyboard system; $2,340 for 24 keyboards; and $3,020 for 32 keyboards. Deliveries begin in July.

Consolidated Computer, Ltd., 235 Wyman St., Waltham, Ma. 02154. (617) 891-0210.

CIRCLE NO. 353

Point-of-sale units use magnetic-tag reader

A complete point-of-sale system can handle a storewide network of up to 256 electronic sales terminals each equipped with magnetic-tag reader. The terminals are available in three basic configurations: as stand-alone models that capture data on tape cassettes for off-line processing; as stand-alone terminals that may be equipped with two-way communications capability for automated credit checking and central data collection; and as on-line terminals, in which all functions are programmed and controlled centrally. The system contains a minicomputer linking from 16 to 256 terminals. Through a peripheral disk file, the central processor can provide credit verification and update. Software enables the system to accumulate operating data in-store, providing sales audit, volume and performance figures to branch store management. The in-store processor can also maintain communication with a headquarters data center, transmitting summarized daily operating figures, all merchandise sales data and accounts receivable information. Other units available include a crt terminal for accessing the retailer's data processor and a tag writer which incorporates magnetic coding with the Kimball punched tag that is now in wide use. Thus retailers can make a transition from current batch reading of punched tickets to an automatic reading system utilizing a standard ticket. Price of the Sweda 700 series system is about $3,300/terminal for a typical system

of 80 terminals. Extra terminals are available for prices starting at $2,800. Deliveries will begin in late 1971.

Sweda International, 550 Central Ave., Orange, NJ 07051. (201) 673-7100.

CIRCLE NO. 352

Identify all the costs of your edp department

The intent of the "Realcost" package is to identify all costs associated with the operation of a data processing department. It produces 10 reports: a dollar distribution report by system and by cost center; a time report by system and by hardware; five equipment reports, including a keypunch evaluation; and three personnel reports. Written in Cobol, it operates on an IBM 360/50 or up under OS or DOS with 48k of core. The price is $6k and lease is $180 per month.

Comtrol, 1800 Silas Deane Hwy., Rocky Hill, CT 06067. (203) 563-2349.

CIRCLE NO. 354

a thought about you...

BAFFLED

What's your particular problem? An OEM user is faced by a multitude of choices, not the least of which is the selection of the right minicomputer for an application.

Do you require a flexible, reliable, competitively priced, general-purpose minicomputer? Do your needs include on-time deliveries, good service, and thorough training? If your answer is yes, the CIP/2100 from Cincinnati Milacron can end your bafflement. The CIP/2100 won't make coffee for you, but it can solve your minicomputer problems. Call a field salesman today and let him explain its advantages to you over a cup of coffee.

minicomputers

CINCINNATI MILACRON

Cincinnati Milacron Company | Cincinnati, Ohio 45209

Machine Tools
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INFORMATION RETRIEVAL NUMBER 18

Medium-scale system for scientific batch jobs

The medium-scale PDP 15/50 system is designed for the processing of scientific data. Core memory on the system ranges from 16k 18-bit words to 131k words and has a cycle time of 800 nanoseconds. Arithmetic operations are speeded by a floating point processor with an eight microsecond add-time. The Fortran IV language used with the system includes disk statements for random access. Other languages available include Algol and the macro machine assembler. Base price for the PDP-15/50 is $114,900 ($3k per month lease) and includes 16k of core memory, extensive software subroutines, teleprinter, magnetic tape drive and controller, a disk pack controller and drive with a capacity of 10-million words of data, paper tape reader/punch, real-time clock and an extended arithmetic element for integer arithmetic and logical shifts. Deliveries begin within four months.

Digital Equipment Corp., 146 Main St., Maynard, MA 01754. (617) 897-5111.

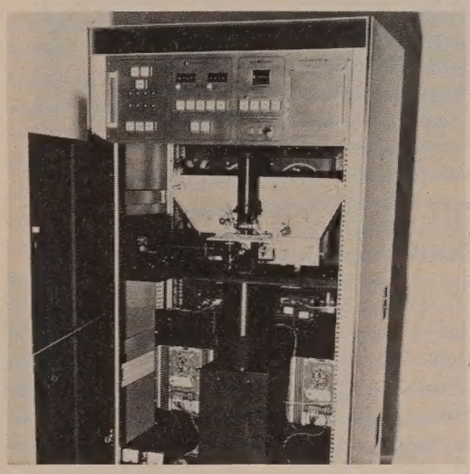
CIRCLE NO. 224

Window accounting computer operates on- or off-line

The L 3000 Window Accounting Computer is designed for users who conduct business with customers through window or counter operations. The computer incorporates passbook and audit control features. It comes in three styles which possess self-contained memory and logic for off-line accounting, and also have the capability to be converted to on-line operations for remote site data communications use. Programs for the L 3000 are written in Cobol. An alphanumeric keyboard and a numeric keyboard permit manual input with visual communication between the operator and the computer. The three new L 3000 styles, which range in memory capacity from 256 to 320 words, are available for sale at prices ranging from $8,990 to $11,990. Lease prices range from $225 to $300 per month.

Business Machines Group, Burroughs Corp., Second Ave. at Burroughs, Detroit, MI 48232. (313) 972-7084.

CIRCLE NO. 225



Scanning system extracts data from film

The Model O/S 2000 system is a flying-spot scanner capable of reading data from standard 35mm or microfilm negatives. It also has the capability to write data on unexposed film. In applications such as biophysics, medical electronics and pollution monitoring, the system has the power to resolve 20 micron spot sizes and to classify up to 64 levels of intensity for gray-scale reading and writing. Each unit is supplied with a high-speed input/output bus for computer control of the entire machine including scanning, film drive control, data reading and writing. Interfaces are available for most popular computer systems. Prices start at $59,000 per system, which includes a video monitor and computer interface. Delivery is within six months.

Megadata Computer and Communications Corp., 10 Evergreen Place, Deer Park, NY 11729. (516) 667-2900.

CIRCLE NO. 226

IBM 360/22: medium size at a moderate price

The 360/22 general-purpose computer offers intermediate-scale data processing capability. The Model 22 runs under DOS and provides the opportunity for using Cobol, Fortran and RPG II. A multiplexer channel and selector channel allow the attachment of medium-speed magnetic tape and disk storage drives, as well as other peripheral equipment. The system will be available in two main-storage sizes: 24K bytes and 32k bytes. One byte can be placed into or retrieved from main storage in 1.5 microseconds. The basic cycle time of the central processing unit is 0.75 microseconds. The monthly rental for a typical system with 24K bytes of main storage will be about $5,600, with a purchase price of about $246,000. Delivery is within four months.

IBM Corp., Data Processing Div., 1133 Westchester Ave., White Plains, NY 10604. (914) 696-1900.

CIRCLE NO. 227

Merchandising system for retail store outlets

A computer-aided merchandise control system offers non-computer oriented users flexible control over their department and retail stores. The System 50 offers store control personnel non-linear sales analysis capability. To permit customer credit verifications to be executed quickly and to facilitate acquisition of inventory and sales data at the point-of-sale, System 50 relies on dedicated terminals to perform the traditional functions of cash register. The terminal captures all pertinent product data at the check-out station through an optoelectronic scanning modem. Systems including terminal and computer are priced from $30,000 with delivery within three months.

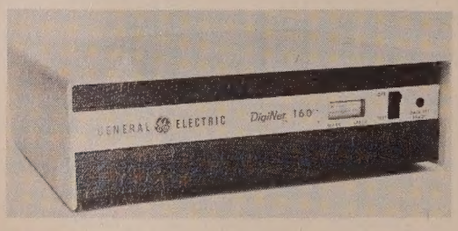
Logik Werdstatt GmbH, Data Code Div., 110 Savin Hill Ave., Boston, MA 02125. (617) 436-2600.

CIRCLE NO. 228

Buffers allow terminals to send/receive at 2,400 bps

Designed for communications networks, the Wiltek Data Communications Terminal has two buffers which provide 50,000-character storage. This allows the terminal to automatically send and receive at speeds up to 2,400 bits per second without interrupting data entry. Transmission is fully automatic. The unit is being offered initially with a choice of two data entry devices: the Wiltek 300, which employs a Teletype Model 33 KSR, and the Wiltek 500.
Prices for the unit range from $3,900 to $6,500; delivery is 90 days.
Wiltek, Inc., 59 Danbury Rd., Wilton, CT 06897. (203) 762-5521

CIRCLE NO. 234



Multiplexer system has own internal diagnostics

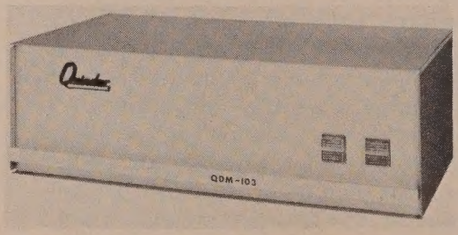
Equipped with simple internal diagnostics which allow the operators themselves to check network or component trouble, the DigiNet 160 series of private-line data multiplexer systems provides multi-channel and multi-point transmission capability to telecommunication networks.
The units have a channel speed intermix capability to combine high- and low-speed equipment within the network. In operation, DigiNet 160 equipment moves data over leased or private four-wire voice-grade circuits in systems where permanent connections are needed between terminals and computer. No data set is required since the unit connects directly to the telephone line.
Price is $1,300 per channel; delivery is 30-90 days, depending on quantity.
General Electric, Section P, P.O. Box 4197 Lynchburg, VA. 24502.
(703) 846-7311.

CIRCLE NO. 235

Off-line tape reader handles any IBM tape

A read-only system for off-line operations, the Model 8197 universal tape reader is capable of reading IBM-compatible tape: nine-track, 800/1,600 bits per inch; or seven-track, 200/556/800 bpi, NRZI or phase encoded. All outputs of Model 8197 are deskewed and buffered, and all densities are switch-selectable. Dual speed operation for identical data rates is optional with 1,600 bpi operation.
The single unit price of Model 8197 is $8,300; $6,640 in quantities of 100. Delivery is 45 to 60 days.
Kennedy Co., 127 N. Madison Ave., Suite 302, Pasadena, CA 91101.
(213) 798-0953.

CIRCLE NO. 236



Modem runs at 300 baud over leased lines

Designed for both full-duplex and half-duplex serial data transmission over voice bandwidth private or leased lines at up to 300 baud, the QDM-103 data modem can be used in the same manner as the Bell System 103F data set. The unit uses channel filters of Teletype quality that permit the multiplexing of several independent channels over one voice-grade circuit. The number of channels that can be provided depends on the bandwidth and data rate selected. The QDM-103 data modem features plug-in modular design of individual components, and conforms with EIA Specification RS232B. Modulation employed is frequency shift keying.
Price is $575; delivery is from stock.
Quindar Electronics, Inc., 60 Fadem Rd., Springfield, NJ 07081.
(201) 379-7400

CIRCLE NO. 237

Impact printer has 400 KHz transfer rate

A fully buffered, 300-line-per-minute, 132-column impact type printer, the Alpha utilizes standard carbon-interleaved pin-fed paper providing up to six clear, sharp copies. The use of an ink roller eliminates complicated ribbon mechanisms. The unit has a standard ASCII 64-character subset; the 132-character buffer can handle data transfer rates up to 400 KHz (bit parallel). Electronics include either a basic parallel interface for use in common system application or a full serial or parallel interface for minicomputers.
Prices for the unit with 132-column buffer start at $7,560 in quantities of one to nine. Delivery is 90 days.
Syner-Data Inc., Route 128, 133 Brimal Ave., Beverly, MA 01915.
(617) 927-3222.

CIRCLE NO. 238

If we advertised a remote terminal system that would keep on working when the phone line was out, you'd find it a little hard to believe.

Most remote terminal systems depend on the communications line to the main computer to keep them working. When the line goes down, the terminal is out of business. That isn't true anymore. System IV/70—with a stand-alone network of up to 32 CRT terminals—can go right on working, phone line or no phone line. You can continue to enter and process data and store the input on local disk or tape—even when communications to the main computer fails. How? System IV/70 includes a full-scale, general purpose computer with the first monolithic semiconductor main-frame memory, total MOS/LSI design, and the computing power of an IBM System/360 Model 30—but at just $36/terminal/month. That makes a perfect direct replacement for IBM's 2260/2848 terminal system. Write for more reasons why companies in the manufacturing, insurance, financial, transportation, publication, and other industries are turning to System IV/70—the data base access system of the 70's.

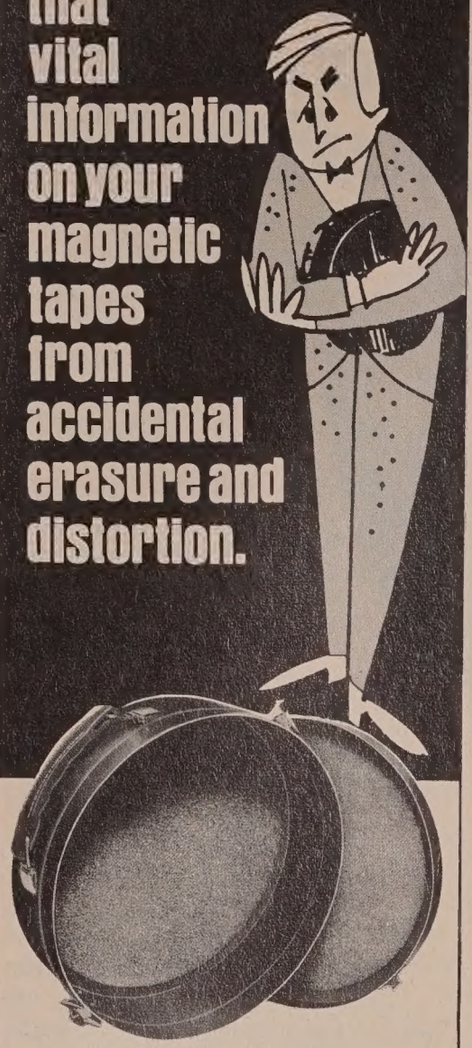
FOUR-PHASE SYSTEMS, INC.

10420 N. Tantau Ave., Cupertino, Calif. 95014 (408) 255-0900

Sales offices in New York (212) 838-0130, Chicago (312) 693-5020, Los Angeles (213) 641-6060, and San Francisco (408) 255-0900

INFORMATION RETRIEVAL NUMBER 20

Protect that vital information on your magnetic tapes from accidental erasure and distortion.



Rugged permanent, netic Tape Deta Preservers will do just that.

- Shielding quality remains permanently effective and are insensitive to shock.
- Illustrated is No. TPR 508, 12" diameter, 3½" deep. (Will preserve 2 tapes)
- Weight 6 lbs. 3 oz. Has handy handle for easy carrying.

Low cost $29.95.

Enclose check and mail coupon today . . .

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Perfection Mica Co.
750 Thomas Drive • Bensenville, Illinois 60106
(312) 766-7800

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Please rush me:

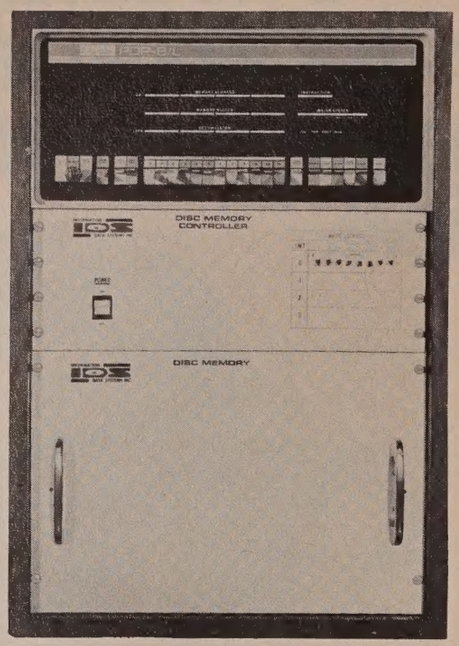
_____ Tape Data Preservers at $29.95 ea.
Quantity

☐ Money Enclosed ☐ Send Literature

Name _____
Company _____
Address _____
City _____
State _____ Zip _____

INFORMATION RETRIEVAL NUMBER 46

NEW DEVELOPMENTS **PERIPHERALS**



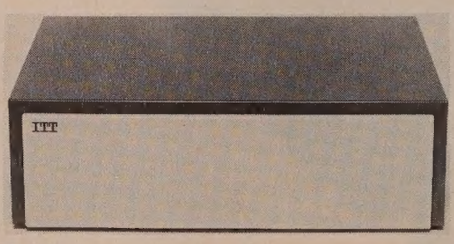
Disk controller is compatible with DEC minis

Directly compatible with DEC PDP-8 and PDP-8L computers, a new controller can operate with standard IDS series 7000 or series 10,000 disk files. The controller's interface signals correspond with the PDP-8's programmed data transfer and three cycle break facilities. Functional electronics in the controller include a 12-bit address register, a 12-bit status register, unit decode, read/write control, data format conversion, OP code decode and control, and memory sequence control circuitry. Average access time is 16.7 milliseconds. Word transfer rate is variable depending upon the capacity of the disk data storage system employed.

Prices start at $1,800; deliveries are 30-60 days.

Information Data Systems, Inc. 7550 Walnut Lake Rd., Walled Lake, MI 48088. (313) 624-5525.

CIRCLE NO. 314



$40/month modem can operate at 2,400 bps

Capable of accommodating data rates of up to 2,400 bits per second, the ITT 2003 modem is designed for use with remote terminals, crt displays, data terminals and other high-speed devices. The unit is priced at $40 per month, and includes a built-in delay equalizer. It may also be utilized over the dial-network or unconditioned lines at 1,200 bits per second. Also featured is asynchronous and/or synchronous operation, a desk-top housing cabinet or mounting in a 19-inch rack. A supervisory control channel option for error detection and correction use is expected to be announced shortly. The unit is expected to be available during the second quarter of 1971.

ITT Data Equipment and Systems Div. East Rutherford, NJ 07077. (201) 935-3900.

CIRCLE NO. 315

CRT is interchangeable with Model 33 and 35 Teletypes

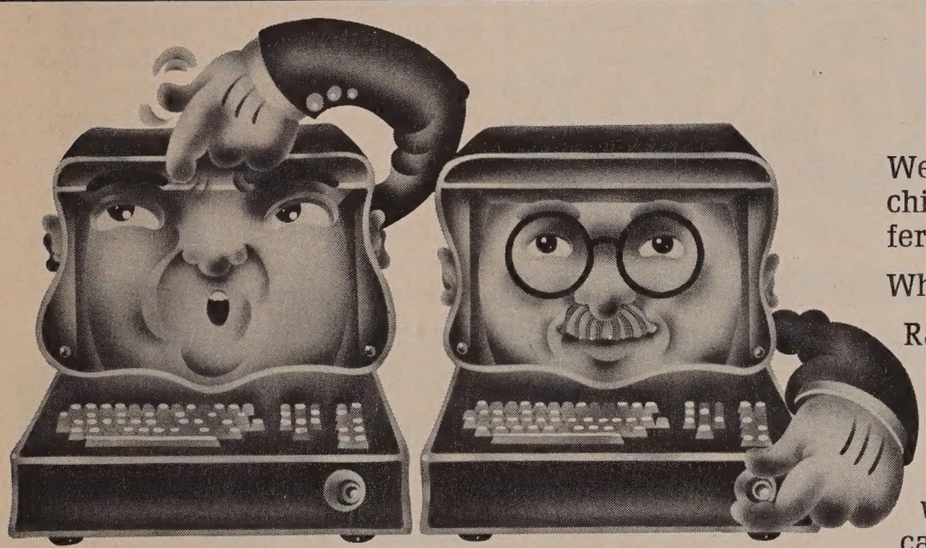
Completely interchangeable with Model 33 and 35 Teletypes, the CC-235 Totelcom is fully compatible with existing Teletype programs, programming practices, and input/output formats regardless of the central computer utilized. It is designed to replace Teletype units in communications network without requiring hardware of software modifications. In operation, the unit permits the entry and editing of displayed data on the crt screen for on-line use and provides the necessary storage for input/output transmission of data over a wide range of data rates. The Totelcom uses the ASCII character and code set and displays the 64 character upper case graphic subset in a flicker-free format of 12 lines of either 72 or 80 characters (switch selectable).

The single unit price of Totelcom is $4,250, and $3,950 with RS-232-B interface. Deliveries are beginning now.

Computer Communications, Inc. 701 W. Manchester Blvd., Inglewood, CA 90301. (213) 674-5300.

CIRCLE NO. 316

Why settle for a boob tube when you can get one with a brain?



Conventional display terminals are fine for certain jobs. But some people want a terminal that can adapt to change. Or tackle a lot of different jobs, even do some thinking on its own. So we developed one—a display terminal with a built-in computer.

It's small, but it's plenty powerful. It's also versatile: to change the project, change the program. This resident computer gives the terminal user its undivided attention, instantly and always. Of course, when access to vast, central data banks is called for, our terminal, like all the others, is perfectly capable of acting as an electronic window...it's intelligent, but not proud.

We'll tell you more about our new brainchild at the Spring Joint Computer Conference. Look us up, we'd like to meet you.

Who are "we"?

Raytheon Data Systems Company. We're new, but we have some distinguished ancestors. Raytheon Data Systems Company has fused Raytheon's Computer and Teleprocessing activities with our expertise in telecommunications. The result is an entirely new company—with decades of experience.

It's also a unique company: the only supplier with proven expertise in both data processing and data communications. The only one able to provide an entire information system, from start to finish including the transmission of data. We can design it, build it, install it, refine it, maintain it, and teach your people how to use it. All of it—from hardware to software. All you have to do is tell us what you need. If you don't need a whole system, we can handle any part.

We offer all there is.

RAYTHEON

Raytheon Data Systems
Norwood, Mass. 02062, Tel. (617) 762-6700

INFORMATION RETRIEVAL NUMBER 49

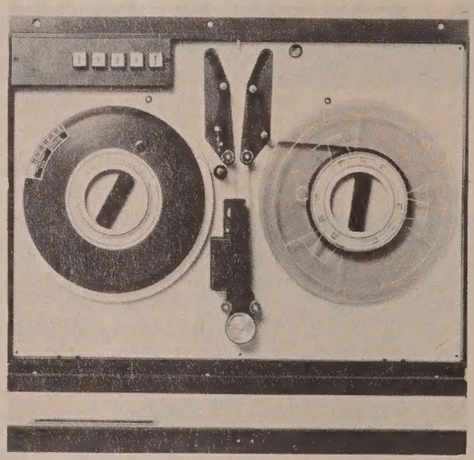
See us at the Spring Joint Computer Conference, Area 2405.

Peripherals turn 4k mini into remote-batch terminal

Two peripherals — a medium-speed line printer and a compact card reader — are designed for use with the Qantel V business computer. When combined, the three units compose a remote-terminal installation which can be installed for approximately $30,000. This would include a three-microsecond processor with a 4k memory, line printer, card reader, and communications controller with automatic dialing and interrupt/receive. The line printer operates at a speed of 200 lines per minute. It sells for $11,500 or leases for $355 a month. The card reader handles standard 80-column cards, and translates data in ASCII code. It is priced at $3,950, and leases for $122 a month. Delivery is four months.
Qantel Corp., 3474 Investment Blvd. Hayward, CA 94545. (415) 783-3410.
CIRCLE NO. 317

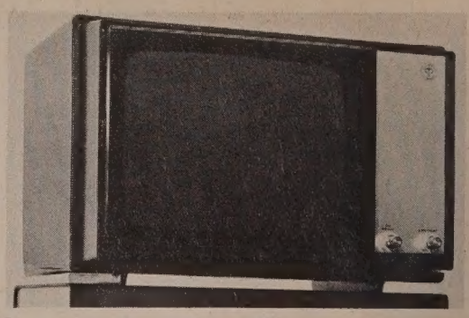
Remote-batch terminal hooks to DEC PDP-10's

A remote-batch processing package for the DEC PDP-10 computer consists of a DC71 remote station, a DS10 synchronous line interface, a software communications extension to the PDP-10 monitor, and communications software for the remote station. The DC71 remote station, includes a 200-card-per-minute card reader and a 350 line-per-minute line printer
It is based on DEC's small PDP-8/I computer, and includes a library of stand-alone software, as well as the terminal-oriented routines. The DS10, is an interface between the PDP-10 input-output bus and a single line synchronous modem such as the Bell 201B data phone. A DS10 is required for each active remote station. Price of the DC71 and DS10 is $53,000. Prices for a PDP-10-based system with remote-batch terminal, starts at $536,000. In operation, the system gives the user higher throughput by spooling input and output and offering multiprogramming of batch processing jobs, including roll-in and roll-out of batch jobs. The flexibility of PDP-10 hardware and software allows a user to add a time-sharing capability to his PDP-10 remote batch processing system for an additional $15,500.
Deliveries on the remote-batch station are on a 60-day schedule.
Digital Equipment Corp., Maynard, MA 01745. (617) 897-5111.
CIRCLE NO. 318



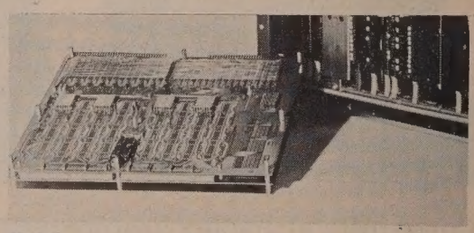
Tape transports are designed for COM, typesetting

Designed for computer output microfilm, offline printing and plotting, and typesetting, the 100R Series of read-only, IBM-compatible tape transports are available with packing densities of 200, 556 and 800 bpi and in seven- and nine-track configurations. A search/read feature of the 100R Series enables the user to search for a file at high speed and to read data at the lower speed of his output device. Read speeds range from one to 37½ inches per second, with maximum search speed of 50 ips. Bad tape recovery features are also included.
Prices for units range from $3,500 to $4,800 depending on configuration and quantity. Delivery is 30-60 days.
Cipher Data Products 7566 Convoy Court, San Diego, CA 92111. (714) 277-8070.
CIRCLE NO. 319



Low-cost crt's offer page-mode operation

Offering a low-cost alternative to data retrieval, data monitoring, inquiry/response, and interactive control needs, the 200 series crt display terminals are available in three models. The 201 communications display features roll-mode operation, in which the screen acts as an endless piece of paper. The 202 computer display features page-mode operation, in which display screen acts as a typewriter, with command-movable non-destructive cursor. The 203 high-speed display features data entry of rates up to two million characters per second. All models are offered with either parallel or serial interface RS232C or current loop, for compatibility with all microcomputers and 103-type data sets.
Prices start at $695; delivery is 15 days.
Ann Arbor Terminals, Inc. 918 Greene St., Ann Arbor, MI 48104. (313) 769-0926.
CIRCLE NO. 320



500-ns modular memory has 4k-65k word capacity

Available in modules that provide memory capacities from 4,096 to 65,536 words and word sizes from 8 to 72 bits, the CC-50 memory system makes available in small capacity systems the performance and cost advantages of 14-mil cores and 3-wire 3D organization. Cycle speed is 500 nanoseconds. The basic building block is a core-stack of 4,096 18-bit words.
Prices start at about 2½¢ per bit; delivery is 90 days.
Lockheed Electronics, Data Prod. Div. 6201 E. Randolph St., Los Angeles, CA 90022. (213) 722-6810.
CIRCLE NO. 321

Look what's happened to PDP-11 since January

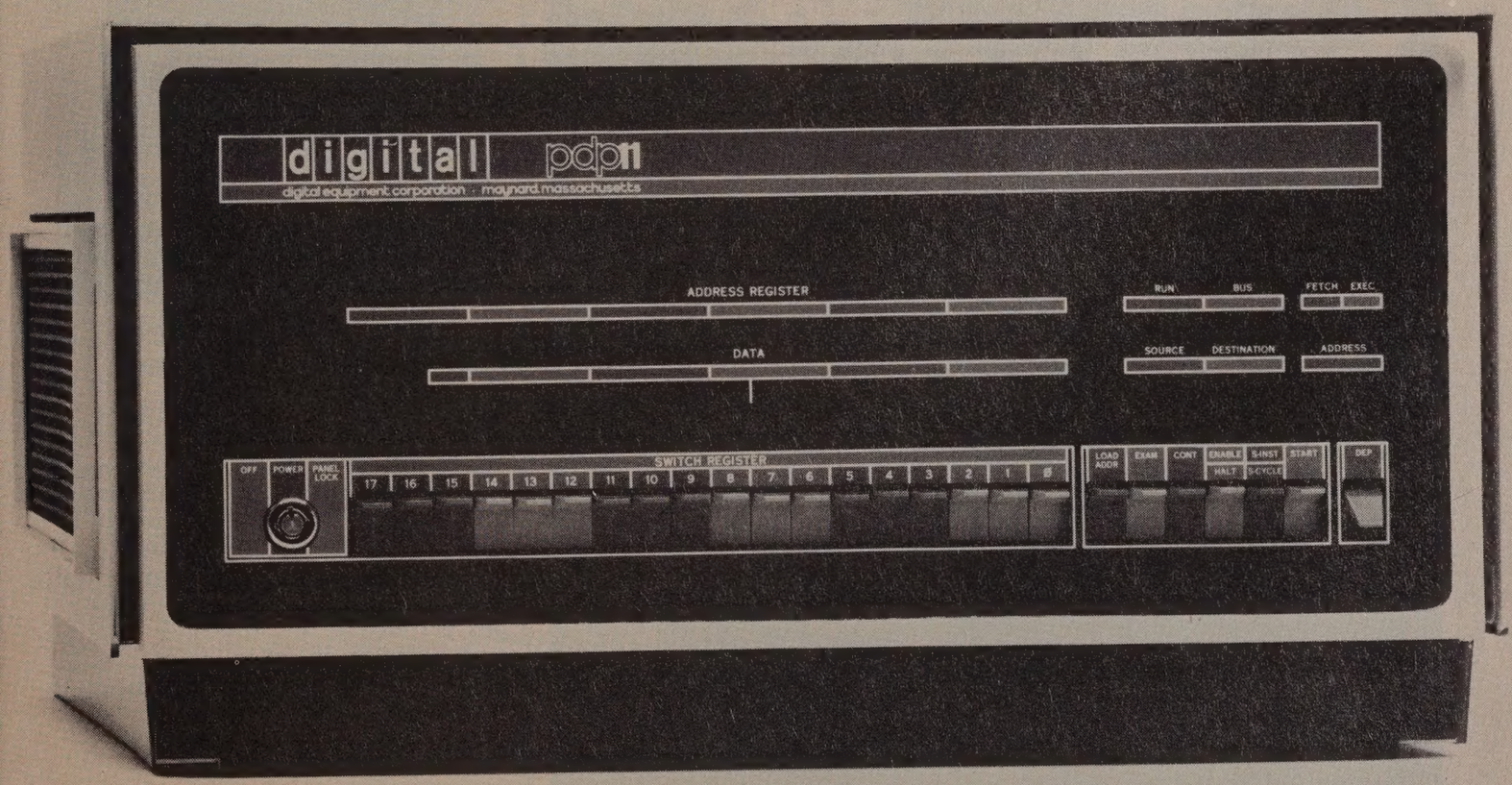
Four months ago, PDP-11 was simply the world's hottest 16-bit computer. It still is. But, now it's more than that.

Now it's a resource timesharing system. RSTS-11. Up to 16 users. With the capacity, easy-to-use language elements, file structure, data-base capacity, and speed you need to handle big computer problems. At far less cost than the HP or Honeywell systems.

Now it's a data communications system. With a data transparent front end for your applications programs. It's a modular, expandable multi-task executive called Comtex-11. Plus four interface units—a single-line multiplexer, a 16-line multiplexer (both asynchronous), a synchronous-line interface and an automatic-calling interface.

Now it comes in a rugged version. The PDP-11R20. With vibration, shock, temperature, and power-line specs that make it the toughest machine in the industry. And at a price that lets it fit commercial applications without a strain on the pocketbook.

All this has happened since January. But it's just a beginning. More PDP-11's are coming. Watch for the next additions to the growing PDP-11 family. Digital Equipment Corporation, 146 Main Street, Maynard, Massachusetts 01754, (617) 897-5111.



digital

INFORMATION RETRIEVAL NUMBER 21

Improving the efficiency of your computer systems in this cost-conscious economy is probably the biggest headache you have. And, that's why you should get complete information on the latest techniques in computer system performance evaluation:

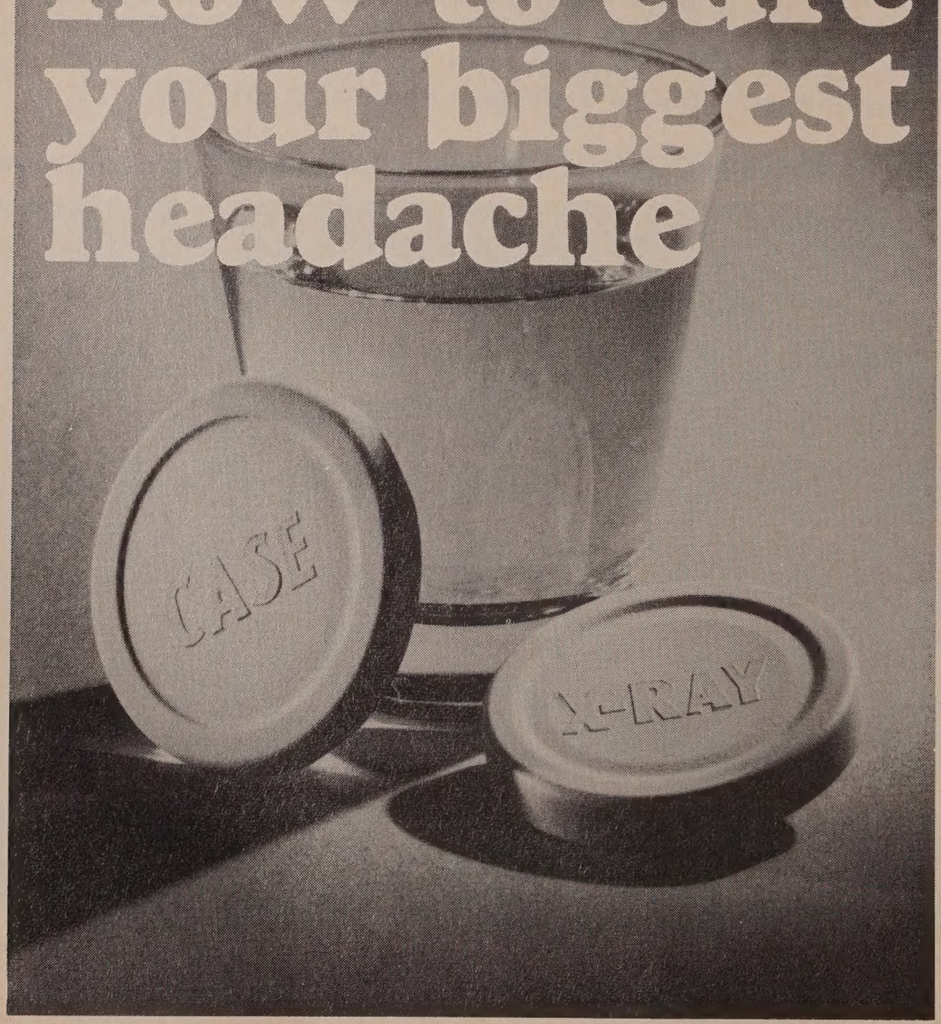
For monitoring total system performance X-RAY™ is a unique hardware/software system capable of analyzing all aspects of *current system performance* including configuration utilization, system software overhead, application program efficiency, and program and data base organization.

For simulating even the most complex aspects of *planned or existing multiprogramming, real-time or time-sharing systems,* CASE is the least costly way to make system decisions . . . CASE will accept system and workload measurement data generated by X-RAY and predict the interaction of virtually any combination of hardware, software, data base and user programs.

X-RAY and CASE can be used together to provide a complete computer performance evaluation system. X-RAY and CASE are available independently or as a system under purchase, lease, license or service plans. For complete details, contact:

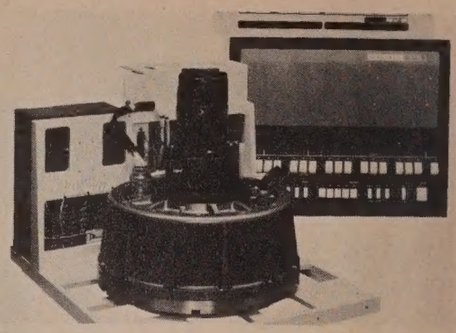
APPLIED SYSTEMS
Division of Computer Learning & Systems Corporation
5530 Wisconsin Avenue, Chevy Chase, Maryland 20015
(301) 652-9220

How to cure your biggest headache



INFORMATION RETRIEVAL NUMBER 22

PERIPHERALS



Rotating-drum mass memories plug into Honeywell minis

Mass-memory systems for Honeywell H-112, H-316 and H-516 mini-computers include a rotating drum mass memory, a controller, power supplies and inter-connecting cables for direct connection to the DDC channel of the H-316/H-516 computers. One controller may handle up to four drum-memory units. Designated the Series 6000 system, the drum memories use head-per-track flying heads. Average access time is 8.7 milliseconds.

Complete system prices start at less than $6,000; delivery is 45-60 days.

Datum, Inc., 170 E. Liberty Ave., Anaheim, CA 92801. (714) 879-3070.

CIRCLE NO. 204

Crt is hardware, software compatible with Teletypes

First of a family of interactive display terminals, the Model 73 is designed to be hardware and software plug-compatible with Model 33 and 35 Teletypes. The display console contains an alphanumeric display, Teletype format keyboard, MOS memory, selectable speeds to 1,200 bits per second, and selectable half- or full-duplex operation.

Price of the unit is $3,950. Delivery is 30 days.

Data 100 Corp., 7725 Washington Ave. S., Edina, MN 55435. (612) 941-6500.

CIRCLE NO. 205

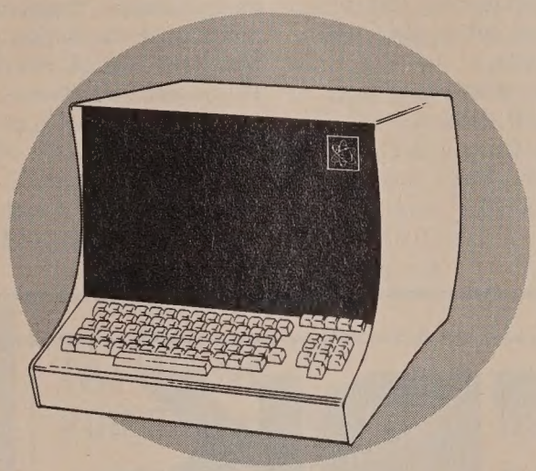
BEEHIVE
TERMINALS

Beehive modularity again proves obsolescence obsolete!

LOWER CASE
and
THREE LEVEL PRIORITY BLINK

now added to Beehive's growing list of product improvement features available through *in-the-field* upgrading

The Lower Case option permits display and transmission of the full 128 ASCII character set. The standard Beehive Terminal already offers dual intensity characters for differentiating between displayed data and control characters. Now, to further assist the terminal user, the Priority Blink option permits displayed data to be highlighted or to be used as selective annunciators. Individual characters, words, lines, or the complete screen may be selected to blink, reverse the video (black on white), or to blink the reverse video.



BEEHIVE TERMINAL MODELS I, II or III

MODEL I
BASIC TIME SHARING

Provides all the minimum functional capabilities required of an alpha-numeric CRT display unit with a teleprinter style keyboard. Has 800 character storage and display (20 lines x 40 ch/line), parity detection and generation, composite video, output, four way control of non-destructive blinking cursor, home and clear, switchable baud rate, scroll overflow, RS 232B interface for full and half duplex operation. Can be changed to a Model II in the field!

MODEL II
BATCH PROCESSING

Has all the capabilities of Model I plus the following: erase screen, erase line, tab, tab set, tab clear, and block transfer. Can be changed to a Model III in the field! or upgraded from Model I.

MODEL III
SOPHISTICATED BATCH AND INQUIRY

Provides all the features and functions of the Model I and II, plus the features required in sophisticated time sharing environments and applications where full editing capabilities are necessary along with (split screen) protected field formatting.

ACCESSORIES
Stand-Alone Cassette
Teleprinter 20/60MA Current Loop Adapter

OPTIONS

MODEL I, II, III	80 Character Line Display Parallel I/O Adapter— Low and High Speed Upper/Lower Case Display 3 Level Priority Blink Export Model
MODEL II, III	Remote Printer Adapter

MODEL CHANGES
Model changes as well as options are possible in the field!

360 USERS ATTENTION!
The Beehive Model IV is plug-to-plug compatible with the IBM type 2845/2265 configuration.

•

Nationwide Maintenance Available
National Sales Representation

BEEHIVE MEDICAL ELECTRONICS, Inc.
1473 South 6th West • Salt Lake City, Utah 84104
801 / 487-0741

INFORMATION RETRIEVAL NUMBER 23

Modem data rate reaches 2,400 bps synchronous

A high-speed data modem is designed for two-wire, half-duplex operation on the dial-up telephone network. The Model 883R can also be operated full-duplex on four-wire lines. Data transmission rates are 2,400 or 1,200 bits per second in the synchronous mode, up to 1,200 bps in the asynchronous mode. The unit may also be operated asynchronously at reduced rates with bit transparency. Internal self-check functions allow DC and audio loop-back tests.

Prices for the unit start at $825; delivery is 90 to 120 days.

Singer Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, NY 11797. (516) 921-9400.

CIRCLE NO. 201

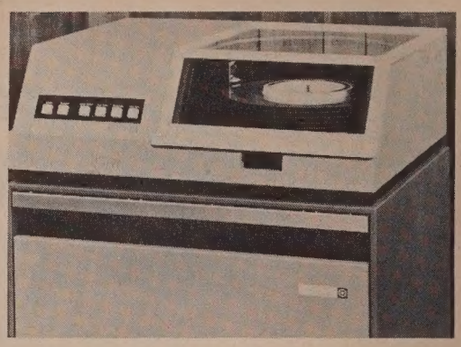
Drum plotter produces drawings at 1,600 in/sec

A high-speed digital drum plotting system, the Model 462, is capable of producing large-scale drawings at speeds of over 1,600 inches per minute (25 inches per second). The system is designed for use in any area or business where computer output data lends itself to graphic presentation. In unattended operation, it can continuously plot in lengths to 125 feet, making it useful in chart and graph drawing. The system configuration consists of the Gerber Series 400 Control and the Model 62 Drum Plotter. Sole input to the control is through IBM compatible, seven-inch, 800 bit-per-inch, nine-track, magnetic-tape transports. The main module of the Series 400 Control is a Hewlett-Packard Model 2100.

Prices start at about $75,000 for a total system. Deliveries will be on a 90-day schedule.

The Gerber Scientific Instrument Co., 83 Gerber Rd., South Windsor, CT 06087. (203) 644-1551.

CIRCLE NO. 202



Direct access storage unit can replace IBM 2311's

A direct access storage unit which employs a removable disk pack as the storage medium, the Model 711 is a direct replacement for the IBM 2311. It interfaces directly to the IBM 2841 storage control unit which can handle up to eight of the Model 711 drives. Data transfer rate is 156,000 bytes per second; average access time is 75 ms.

Price is $9,000; delivery is 30 days.

Peripherals General Inc., Cherry Hill Industrial Park, Cherry Hill, NJ 08034. (609) 424-2008.

CIRCLE NO. 203

TDK®
DATA CASSETTE TAPE CAN MAKE A DIFFERENCE

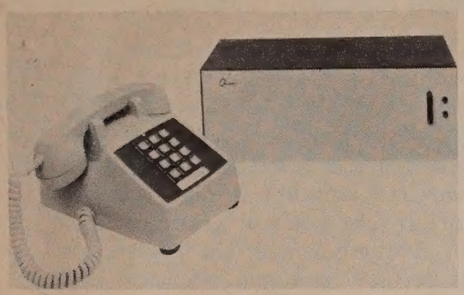
To find out how, visit us at our SJCC Hospitality Suite:

La Concha Hotel
3100 Boardwalk
Atlantic City, N.J.
Tel: (609) 348-9101

Or get in touch with us at our New York office:

TDK®
TDK ELECTRONICS CORP.
23-73 48th Street, Long Island City, N.Y. 11103
Tel: (212) 721-6881

INFORMATION RETRIEVAL NUMBER 24

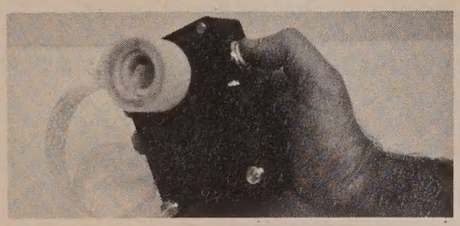


Unit decodes touch-tone signals

A new touch-tone receiver designated the QTTR-20 allows the gathering of data and sending of instructions to and from remote locations via standard telephone lines. The receiver decodes touch-tone signals into bcd or single line. With the unit, phone pushbuttons can be used to transmit control data or request information from remote locations. Reply data can be in code or voice depending on the remote installation. Applications include control functions where leased lines are not justified, plant operational checks, pollution monitoring, office security checks, and municipal and utility data acquisition systems. The units cost approximately $350 and are delivered within one month.

Quindar Electronics, Inc. 60 Fadem Rd., Springfield, NJ 07081. (201) 379-7400.

CIRCLE NO. 206

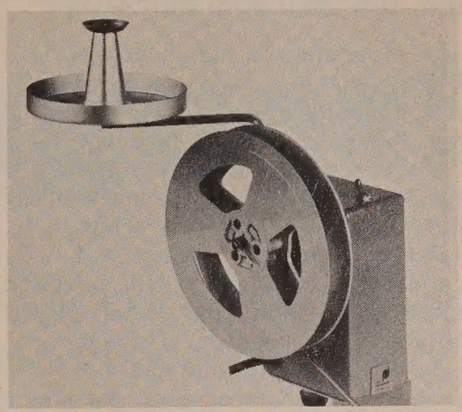


Battery-powered winder for paper computer tape

A portable, battery-operated paper tape winder is designed for ease of operation with input terminals. The unit has a magnetic base for attaching to the base of the terminals. Two standard "C" cells power the unit. The unit costs $50 and is delivered in two weeks.

Tape-Aids, P. O. Box 232 Manlius, NY 13104. (315) 682-5938.

CIRCLE NO. 207



Paper tape handling for teletypewriters

The TW-33 winder and center unwinder is designed for teleprinter punched paper tape programs. The unit slips onto the leg of a Model 33ASR teletypewriter. The center unwinder will handle up to 400 feet of tape and the winder is equipped with an eight-inch take-up reel. Price is $149. Delivery is within two weeks.

Pivan Data Systems, Inc., 6955 N. Hamlin Ave., Lincolnwood, IL 60645. (312) 676-0790.

CIRCLE NO. 208

Free brochure on new portable CRT computer terminal.

It's the Logiport/1, the first truly portable, remote-access CRT terminal with integral acoustic coupler. Available immediately, it's incredibly priced at under $3,000. Compact design fits easily on desk top. Easy-to-read, 32-character-line, alphanumeric display. Interactive Terminals Corporation, 197 Albany St., Cambridge, Massachusettes 02139. A subsidiary of The Bendix Corporation.

Bendix

INFORMATION RETRIEVAL NUMBER 43

The WANG 700 Series

Now a calculator that lets you write your own programs and store them on a tape cassette

It's easy to store, enter or change programs with a 700 Series and there are no language problems. You already have the knowledge in the math steps you're now using to solve your problems.

With the Wang 700 you'll have more than a calculator. There are 16 special function keys that make it personally yours – you can determine the function each performs. And a choice of typewriter or printer/plotter output turns the 700 Series into a fully programmable calculating system.

And to make it even easier, Wang offers a library of preprogrammed cassettes for the many standard needs. Want a demonstration? Call Mr. Courtney collect at 617-851-7211 or send us the coupon.

Wang Laboratories, Inc. Dept. CD-5
836 North Street, Tewksbury, Mass. 01876
I'd like a 700 demonstration as soon as possible. Call me at _____ for a date.
(Phone number)
Name _____
Company _____
Street _____
City _____ State _____ Zip _____

INFORMATION RETRIEVAL NUMBER 44

Cobol and BAL debugging aid for 360's under DOS

The programmer's aid in debugging (PAID) module can be used with all IBM 360's under DOS for Cobol or BAL programs. Using a modular concept, PAID operates in either a remote or hands-on environment. The module has the ability to detect, validate, record on printer, and continue processing any data exception that occurs during the testing phase of a problem program. Through external interrupts, PAID can also produce snapshots of core, patching, or branch to any location for further testing of the problem program. The self-loading object programs of the PAID module, together with the operations manual, sells for $350.

MPIRS Associates, Inc., 507 Fifth Ave., New York, NY 10017. (212) OX 7-5895.

CIRCLE NO. 240

Accounts payable package improves cash control

An automated vouchering system provides management with a convenient method of controlling cash disbursements. The system automates accounts payable processing and provides complete accounting control over disbursements and their related accounting distribution. The system automates the clerical functions required to voucher an invoice but still gives the user freedom to manually override the automated functions. Up to 999 companies can be processed by the system, and each company can have its own unique organization coding. The system allows the user to determine his own payment cycle. The package is written in Cobol and produces 20 different reports. It will run on IBM/360's under OS or DOS, on Honeywells' 200 series and on Spectra 70's under TDOS. The program requires 32k of core memory and three files, including one disk. Price is $10k with delivery in one week.

Ancom Systems, 8929 S. Sepulveda Blvd., Los Angeles, CA 90045. (213) 649-1616.

CIRCLE NO. 241

Flow charting processor for Fortran programs

An automatic flow-charting processor called Hi-Flow provides complete and automatic documentation of Fortran programs. In addition to flow-charting Fortran programs, Hi-Flow renumbers statements and all references logically and produces a new deck or decks of the original program in the new form. Hi-Flow requires a total of seven input/output devices and requires approximately 160k bytes of core storage or, with overlay on the IBM 360, requires approximately 100k bytes of storage. The flow chart is produced on a Complot digital plotter. Cost of the flow-charting processor is $3,800 on a three year lease.

Houston Instrument, Inc., 4950 Terminal Ave. Bellaire, TX 77401 (713) 667-7403.

CIRCLE NO. 242

Simulator to run 1401 programs on a 360

The 1401 Super/sim is a software simulator which executes 1401 programs on S/360 under the control of PCP, OS/MFT, and OS/MVT. 1401 Super/sim features spooled output to optimize printer utilization, operating system allocation of tape drives to improve throughput, and card-inserted simulator commands to reduce operator intervention. The simulator supports all standard 1401 features plus advanced programming, sense switches, move record, tape, multiply/divide, expanded print edit, and 1311 disk storage. The package requires a maximum of 80k core storage, including the 1401 program. It is priced at $475.

Hygain Technologies, Inc., 65 Whitney St., Westport, CT 06880. (203) 226-5931.

CIRCLE NO. 243

Fortran subroutines to conserve core

A set of subroutines called "Sparse" is used for inverting matrices to conserve core by not saving the zero elements in the matrix. Sparse takes in a description of the matrix list form. Each element value and its row and column position in the matrix is contained in the list. Sparse can handle real, complex or double precision matrices and will work on non-symetric matrices. The sub-routines are written in standard Fortran IV and will operate on any computer supporting this language. The Sparse is priced at $2,000.

Environmental Computing, Inc., 21 George St., Lowell, MA 01852. (617) 453-7745.

CIRCLE NO. 244

Package expands data handling of ATS/360

The "keyword locate" software package is designed to expand the data handling and information retrieval capabilities of ATS/360. The program allows the user to search a working storage document for any character or group of up to 48 characters, with the exception of certain relational operator-reserved words. The user can choose from a variety of options in deciding how he wants to work with selected records. The lease price including full term maintenance is $400 per month. The package is supported under both OS/360 and DOS/360.

Systems 2000 Corp., 2015 First National Life Bldg., Houston, TX 77002. (713) 227-3625.

CIRCLE NO. 245

Cobol program to create and edit data files

A program called "Editor" generates a debugged Cobol source program which will edit input data, create data files, update and maintain files. It requires a Cobol compiler and a 42k partition. It runs under IBM DOS and OS, and has been implemented on Univac 1108 (Exec 8) and RCA 70 computers. Some additional features of Editor are that it will edit for ranges and/or specific values, edit for blank fields, use card, tape or disk input, make sequence checks, provide subtotals and will accept multiple formatted input. The program is priced at $4,300 including user manual.

MACS, 104 Park Towne Place East, Philadelphia, PA 19130. (215) LO 8-6860.

CIRCLE NO. 246

Generate use reports on IBM DOS Power systems

A computer utilization report system (CURS) for IBM DOS Power users offers complete flexibility by allowing custom formats to be cataloged within the system. It produces detail and summary reports, totals and subtotals. It has the ability to weight the hourly usage by shift or priority and to produce accurate billing or in-house memorandum figures. The CURS package sells for $950.

Computer General Corp., 1660 L St., NW, Washington, D.C. 20036. (202) 659-2607.

CIRCLE NO. 247

DTS 100 speaks in many tongues!

Inside every DTS 100 remote batch data processing terminal is a little bit of IBM. UNIVAC, too. Also, CDC and BURROUGHS and GE and others.

We designed it that way. We made DTS 100 programmable to communicate with any computer you need—when you need it. In its own language. In-house or on a time-sharing basis. By simple operator-loaded programs. You merely load the language of your choice, dial-up and get on-line.

We made DTS 100 flexible and upward expandable, too. Change or add peripherals—card readers, line printers, card punches, magnetic tape units, CRT's—as your needs grow. To get the most computing power for your money.

Look into DTS 100 remote batch data processing terminals before you're boxed into only one language. DTS 100 speaks them all. Besides, it costs a lot less to use. But, you'll believe that when you see it, right? Write—for Bulletin 1035. Or telephone.

BADGER METER, INC.
ELECTRONICS DIVISION
The new name for Noller Control Systems, division of Badger Meter Manufacturing Company

IBM 360/20 emulation now available. See it demonstrated at S.J.C.C. Booths 1613 and 1615.

DTS 100 is now GSA listed.

MANUFACTURING FACILITY & MAIN OFFICES LOCATED AT 150 EAST STANDARD AVE., RICHMOND, CALIFORNIA 94804. PHONE (415) 233-8220. CENTRAL SALES OFFICE LOCATED AT 4545 WEST BROWN DEER ROAD, MILWAUKEE, WISCONSIN 53223. PHONE (414) 355-0400.

INFORMATION RETRIEVAL NUMBER 29

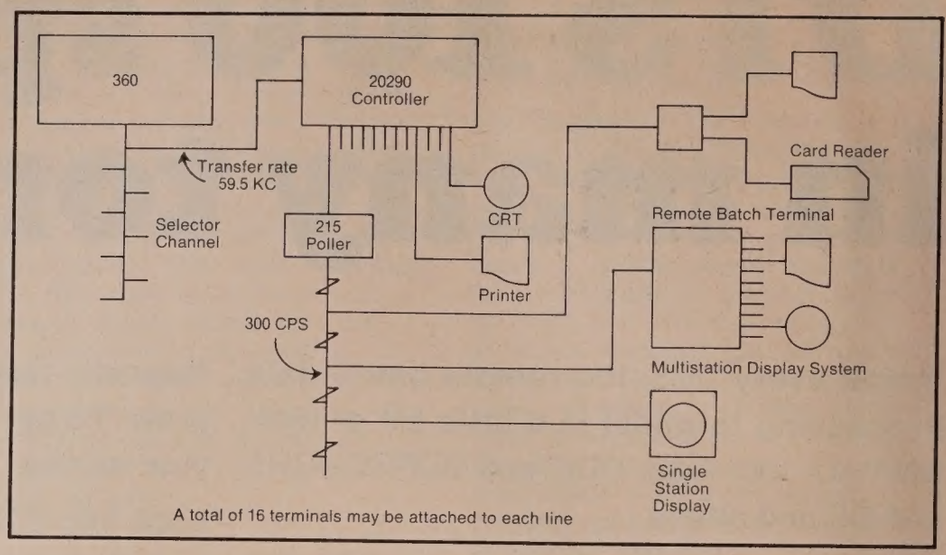
The subject is money: And if you need it and your godfather's busy try getting together with a venture capitalist. Who these people are, where they can be reached and just what they do is the subject of the 185-page "Venture Capital in the United States: An Analysis." Book is neat and well presented aside from being highly informative. Get a copy before you quit and go out on your own. Price $100.
New Enterprise Systems, P.O. Box 29, Cambridge, MA 02139.
CIRCLE NO. 229

General Automation has put together a pocket-sized booklet covering their line of SPC process-control minicomputers. Booklet is a one-stop description, nicely written and illustrated. Very informative for its size, and definitely worth looking at carefully.
General Automation, Inc., 1402 E. Chestnut, Santa Ana, CA 92701.
CIRCLE NO. 230

Fire protection: If bomb-throwing little old ladies or boy scouts rubbing sticks together cause you trouble sleeping at night, do not run to the medicine cabinet. Rather, take a look at "Fires/Impact/Riot/Explosion/Sabotage," a catalog describing data bank safes and how they can relieve a data processing manager's anxiety.
Barry Wright Corp., 160 Gold Star Blvd., Worcester, MA 01606.
CIRCLE NO. 231

Skinny minis: Booklet by that name covers Datamate's Series 70 minicomuters. Nicely presented and illustrated, with details on instruction set, peripheral devices, input-output and support services.
Datamate Computer Systems, Inc., PO Box 310, Big Spring, TX 79720. (915) 267-6353.
CIRCLE NO. 232

Software newsletter: Four-page newsletter published monthly covers doings in the software world. Latest issue (February) has a nice discussion of software packages with advice to potential buyers. Sub rate is $9.00 per year if you are not an ICP member firm. Free if you are.
International Computer Programs, Inc. 2511 E. 46th St., Indianapolis, IN 46205.
CIRCLE NO. 233



Expand your 360: Control Data's Terminal Operations Control System, a hardware/software system (a typical system configuration is shown above) is described in an illustrated brochure. TOCS is designed to provide on-line entry and retrieval for local and /or remote terminals within a single IBM-based system.
Control Data Corp., Dept. 511, P.O. #1980, Minneapolis, MN 55111.
CIRCLE NO. 301

Computer vs PERT: Loose-leaf report entitled "Cost Benefits of Automated PERT (CPM) Networks vs Manual Drafting," compares manual PERT (CPM) network preparation with automation through software/plotters. Illustrated with graphs, formulae and acronyms.
Systonetics, Inc., 600 N. Euclid St., Anaheim, CA. 92801.
CIRCLE NO. 302

Smallest yet: Bunker-Ramo's squashed down BR-1018 computer (see COMPUTER DECISIONS, Dec. '70, p. 46) is described in a series of loose sheets covering the unit's characteristics, organization, software, packaging, and power. Illustrated and concise. Ask for the BR-1018 Computer Description Form.
Bunker-Ramo Corp., 31717 La Tienda Dr., Westlake Village, CA 91316.
CIRCLE NO. 303

4,800-bps modem: Paradyne's MARQ-48 modem for use on unconditioned half-duplex lines is described in an illustrated brochure. System description and specs included. Get one if you're a TC user.
Paradyne Corp., P.O. #5144, 2040 Calumet St., Clearwater, FL 33518.
CIRCLE NO. 304

Should you rent magnetic tape rather than buy it? The case for rental is spelled out in a brochure that discusses the problem from the operational and financial points of view. Coherent.
Time Brokers, Inc., 500 Executive Blvd., Elmsford, NY 10523.
CIRCLE NO. 305

8000 Tape System: 24-page illustrated brochure details the Kennedy 8000 magnetic-tape system and its various components. Included are applications data, and installation and operation. Not for the novice, and not a promotional brochure. Should be read by systems programmers if the purchase of a new tape system is contemplated. Complete, well presented, well written.
Kennedy Co., 540 W. Woodbury Rd., Altadena, CA 91001.
CIRCLE NO. 306

Engineering programs: Computer programs for electrical engineers with such esoteric names as Runge, Bessel, Anvar and Filana are available from Telcomp. Complete list is contained in a four-page listing.
Telcomp Corp. of America, 50 Moulton St., Cambridge, MA 02138.
CIRCLE NO. 307

Flooring. If you're putting in a new installation, a special, raised floor is required. Westinghouse's Access Flooring is described in a four-page, illustrated catalog. Ask for DB 68-350-1.
Westinghouse Electric Corp., Architectural Systems Dept. 4300 36th St., SE, Grand Rapids, MI 49508.
CIRCLE NO. 308

Looking for a computer system you don't have to assemble yourself?

If you're looking for a low-cost computer system, don't spend many months and thousands of dollars trying to put it together. Raytheon Data Systems computer peripherals are already mated to their 700-Series gp computers. A perfect match — from the beginning.

Raytheon Data Systems peripherals are ready to go to work. With tested and proven interfaces. And with software to run them.

For any 700-Series computer there's a wide choice of tape transports for NRZI and phase-encoded data. Multi-speed and multi-format.

There's a low-cost, desk-top line printer that prints 356 eighty-column lines per minute. It prints all ASCII characters and will make 6-part multi-copies. Need more? We have line printers with 132 columns and print speeds from 245 to 1000 lines per minute.

Need just a moderate amount of peripheral random-access storage? There's a low-cost, 96-kiloword disc drive that accesses in 16.7 msec and transfers up to 187,000 words per second. Use up to four drives on our interface.

We have a new mass-storage disc system that gives you direct access to 104 million bytes. Uses an IBM 2316-type pack and has the only hardware variable length keysearch feature available for low-cost computers.

There's a high-speed paper tape reader/punch. And a card reader/punch. And our Miniverter, Multiverter, and Milliverter multiplexing ADC's.

Write for Data File C-208.

Raytheon Data Systems Company, 2700 S. Fairview St., Santa Ana, California 92704. Phone 714/546-7160.

RAYTHEON

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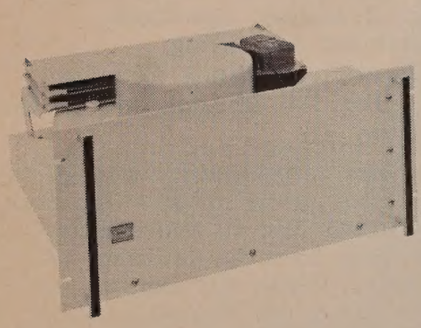

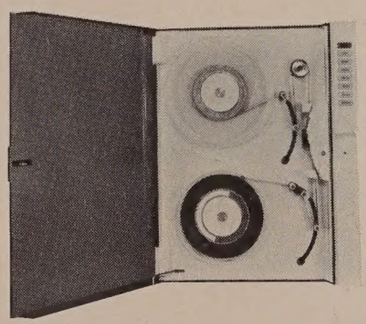

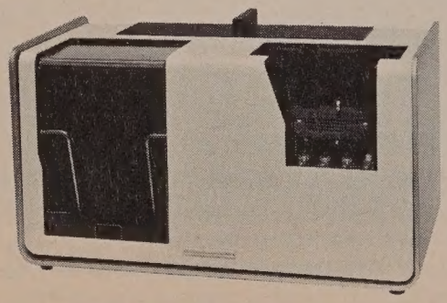

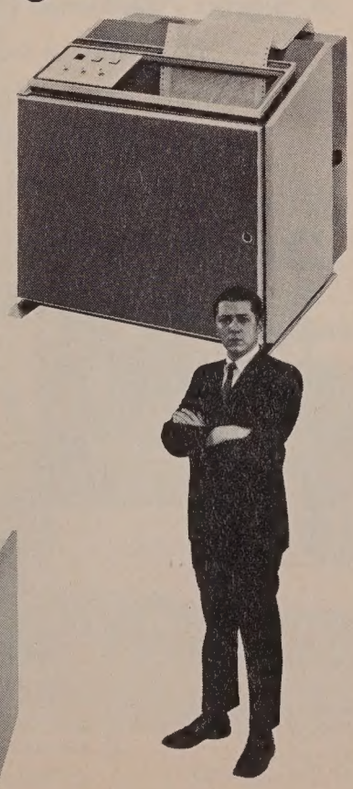

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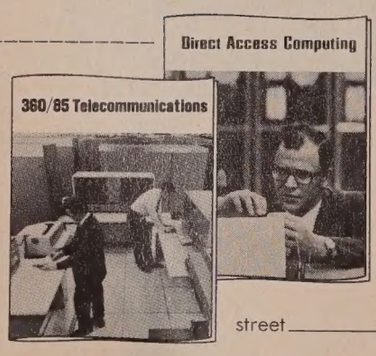

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AMA seminars: What's happening with the American Management Association up to August, '71, is described in an illustrated catalog. Schedule and cost information provided, registration forms included. Courses in the computer area sound most interesting. Get a copy. American Management Association, 135 W. 50th St., New York, NY 10020.

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Hospital information systems: Predictions are bullish for the market for automated hospital systems, with growth pegged at 17 percent annually. Total market is estimated close to one-billion dollars. A detailed 100-page study of this market, with projections through 1980 is now available. Price: $345. Table of contents sent on request. Frost & Sullivan, Inc., 106 Fulton St., New York, NY 10038.

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McDonnell software: Programs available from McDonnell Automation Co. are listed in a pocket-sized 48-page catalog. Timeshared programs cover such areas as business and financial analysis, operations research and engineering. McDonnell Automation Co., Dept. K651, Box 516, St. Louis, MO 63166.

CIRCLE NO. 312

Data base management: 109-page (both sides) report entitled "Data Base Management Systems Requirements" is available from the University of California. Report was compiled by SHARE and GUIDE. Limited number available. Richard Karpinski, San Francisco Medical Center, University of California, Office of Information Systems 76-U, San Francisco, CA 94122.

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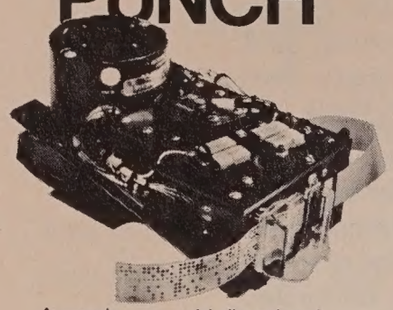

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BOOK REVIEWS

Game plan teaches data processing

Edp Game Seminar, H. F. Spirer and L. Spirer, (Management Games Institute, Larchmont, N.Y.) 105 pages, (plus worksheets) $45.00.

This 'game' is a very well-thought-out attempt to help a manager or businessman to learn some of the fundamentals of computing. Unlike most textbooks, the game does not attempt to explain how a computer works. Instead, it concentrates on showing the reader how to use a computer.

The 'game' is a self-teaching text (not a programmed text) with a series of exercises for the student to perform as he reads the workbook and a series of tests or 'plays' at the end of each of the six chapters. The student completes the plays by filling in instructions on a series of coding sheets that are sent to the Management Games Institute. These plays are run on a computer and returned to the student together with comments on the results and materials needed for the completion of the next lesson.

After working through this book the student will have learned the essentials of one programming language, Fortran, and how to solve simple business problems in terms of creating files, updating and processing information. To give you an idea of the level reached, one of the final 'plays' asks the reader to write a program that will examine a master expense account file to find the employee with the smallest amount of reimbursement to date.

The book is generally well-written and apparently well-tested. The language used throughout is Fortran, whereas one might have preferred to see Cobol since this 'game' is attempting to teach the fundamentals of business data processing. However, the 'game' should be a worthwhile and enjoyable exercise for any executive. *J.N.B.*

CIRCLE NO. 340

See those console lights dance, Dick

Electronic Information Processing, Roger Gupta (Macmillan, New York, N.Y.) 418 pages, $9.95

Do we really need yet another book that tells all, *but all,* about—wait for it, folks—Electronic Information Processing! It's all here—the abacus, Babbage's machines, the core memory (the core memory!!!), octal and hexadecimal numbers, EBCDIC and USASCII, flip-flops (ugh!), flowcharting, how to write (you guessed it) a Fortran program, and much, much more. Unfortunately. Guaranteed to turn the neophyte right off.

I get tired of repeating this, but—you do not need to know how a computer works in order to use it. If we're really going to get the most out of computers and get the most out of the people who are going to need to use them, then let's start showing people how to use the computer and how to use it for their kind of work.

Mr. Gupta, incidentally, is with the College of Business Administration at Kent State University. Mr. Gupta thinks that it's nice for a student to write a program in Fortran so that he may "enjoy the thrill of seeing the console lights dance to the tunes of the instructions written by him."

Seriously, though, this book does contain some useful information. However, it has all been said before and a lot of it in such free sources as IBM manuals. The author may have a course that he can mold around this book but otherwise I cannot see that this book will successfully help many people to use computers. *J.N.B.*

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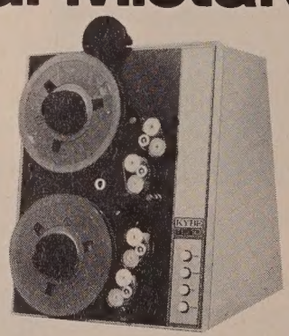

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How to use a computer to write computer languages

A Compiler Generator, William M. McKeeman et al, (Prentice-Hall, Inc., Englewood Cliffs) 527 pages, $13.95.

The explosion of the availability of digital computers to non-technical and commercial users has necessitated the development of problem-oriented languages to facilitate the communication between the user and the black box. To develop specific languages for each class of problem, however, is unrealistic in terms of time and money. The result is a compromise—high-level languages such as Cobol and Fortran. One way to develop new, problem-oriented languages is to create a program which will create these languages. This book describes an attempt to use a computer for just such a purpose.

The program which writes these languages, is written in a subset of PL/I called XPL. This language was then used to write the first XCOM program, which is capable of producing a language compiler. This program, or compiler, was then put to the task of writing the next version of XPL, which was used to develop a more advanced version of XCOM capable of producing a more advanced version of XPL, and so on ad infinitum. The net effect is that the writing of the actual compiler program has been automated, and that it is now possible to envision a wide range of possible languages.

The book itself is, unfortunately, not oriented to the general reader, but rather directed at the authors' students, and is designed and written as a textbook for a course in computer science. A large part is composed of examples to be worked on by the students. Some are frankly labeled as term projects. Now, 'the intelligent student can quickly see' school of teaching may be good pedagogy, but it is severely limiting for a reader who is not a student but is, like myself, an interested reader with no professor to confront with questions at the next meeting of the class. None of the answers to the examples, or suggested solutions to the problems, are given. Further, the book assumes continuous access to both the XPL language and to an XCOM compiler.

These drawbacks are unfortunate, as they detract in strong measure from what could have been one of the most interesting books to be published in computer science this year.

Richard D. Beck

Richard Beck is a software specialist for CBS in New York

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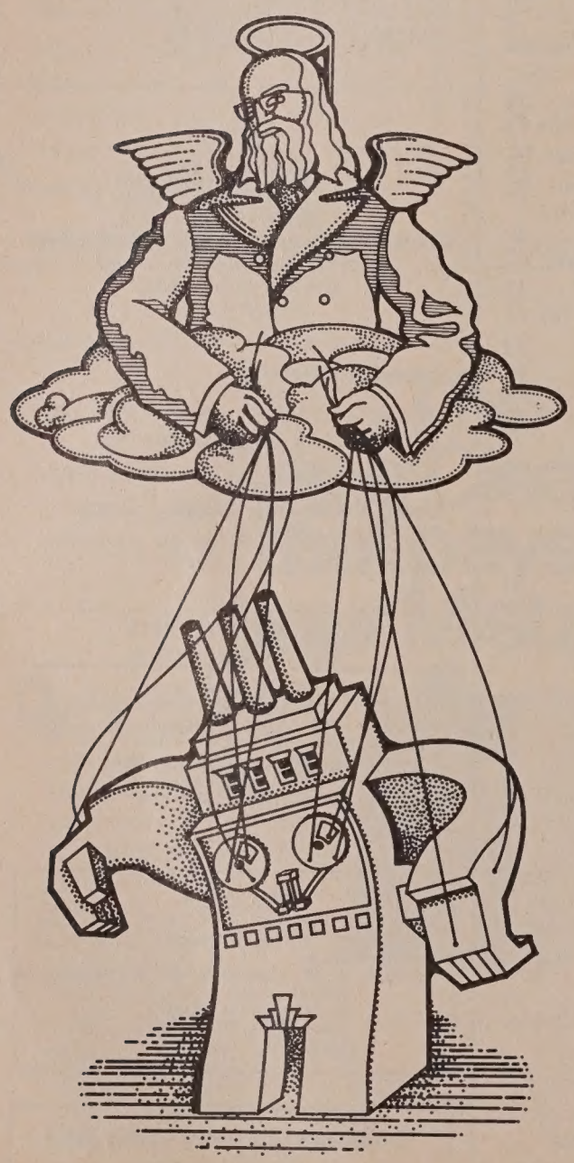

Business and industry in this country have spread out, seeking the production, marketing and other efficiencies offered by mass markets. Lately conglomeration into multi-faceted enterprises has developed because of financial advantages.

These trends have tended to remove upper management from the reality of their organizations. Most top management information today bubbles up through layers of middle management, where it is usually reshaped to fit the "old man's" unreal vision of his organization. With such isolation, how can a top manager really know what is happening at the interfaces between his far-flung enterprise and the outside world, or between different branches of the organization?

In a normal organization things are continually going wrong. The mark of an effective manager is the ability to see difficulties early, determine why they are occurring (whether due to flaws in the system or to careless or inept people), and then to imaginatively redirect things to achieve correction. This response, for the manager to be top-notch, must be to sensed opportunities, and to things that are *not* happening that should be, as well as to troubles. Data processing systems have the potential for greatly aiding this activity, particularly at the operating levels where the sales manager must analyze sales activity, the production supervisor output rates, and so on.

But upper management is impatient to turn the power of computers to relieving its own frustrations. During the sixties the detachment of top managers from what was really happening was particularly severe in the data processing area. A status race developed.

Now a new top management syndrome is developing in Management Information Systems. Right now a data processing manager with ten years longevity in a Fortune 500 company has his job in jeopardy because his top management hasn't been getting the kind of MIS output that he hears about in other big organizations. Yet COMPUTER DECISIONS finds that much of the MIS talk has been inflated—or at least premature —and that organizations starting with an intelligent plan and limited initial goals are having the greatest success (see *MIS comes percolating up the organization,* March, pages 14-19).

In some cases we are beginning to see superficial exercises in complex model juggling. Predictive analyses of alternate returns-on-investment, and similar mathematical games-playing, are being urged on top managers. There is nothing inherently wrong with these methods. The trouble arises because no matter how extensive the fine tuning one cannot extract pearls of wisdom, particularly about a clouded future, from coarse, outdated or even missing operating data.

Computer worship has no place in today's sharp business organization. Many forms of data systems can help information flow, identify developing problems, allow cost savings, and much more. Top managers should become involved in this type of activity within their organizations. But, until the proper underpinnings exist, they should avoid even further detachment from reality by using computers to let them play God.

Robert C. Haavind

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New Tape Cassette Unit adds versatility to our teleprinter.

We can now furnish a magnetic tape unit for your General Electric TermiNet* 300 Teleprinter to add fully automatic send and receive capability.

Designed as an alternative to the paper tape reader/punch option presently being supplied, the new accessory, uses standard cassettes and plugs into any TermiNet 300 Teleprinter.

The small compact desk top unit can read, write, rewind or stop with no operator present.

High speed tape transfer rates up to 1200 bps can be obtained.

Additional advantages include compact data storage, reusable tapes, and simplified editing. You can advance or reverse the tape a character at a time with local or remote controls.

This is but one of 18 available options which make the TermiNet 300 Teleprinter one of the most versatile teleprinters on today's market.

For a demonstration, contact your nearest GE Data Networks sales office. They're listed below.

Or give us a call; Dial 703-942-8161 and ask for TermiNet 300 Printer Sales

General Electric Company, Data Communication Products Department, P. O. Box 4197, Lynchburg, Virginia 24502.

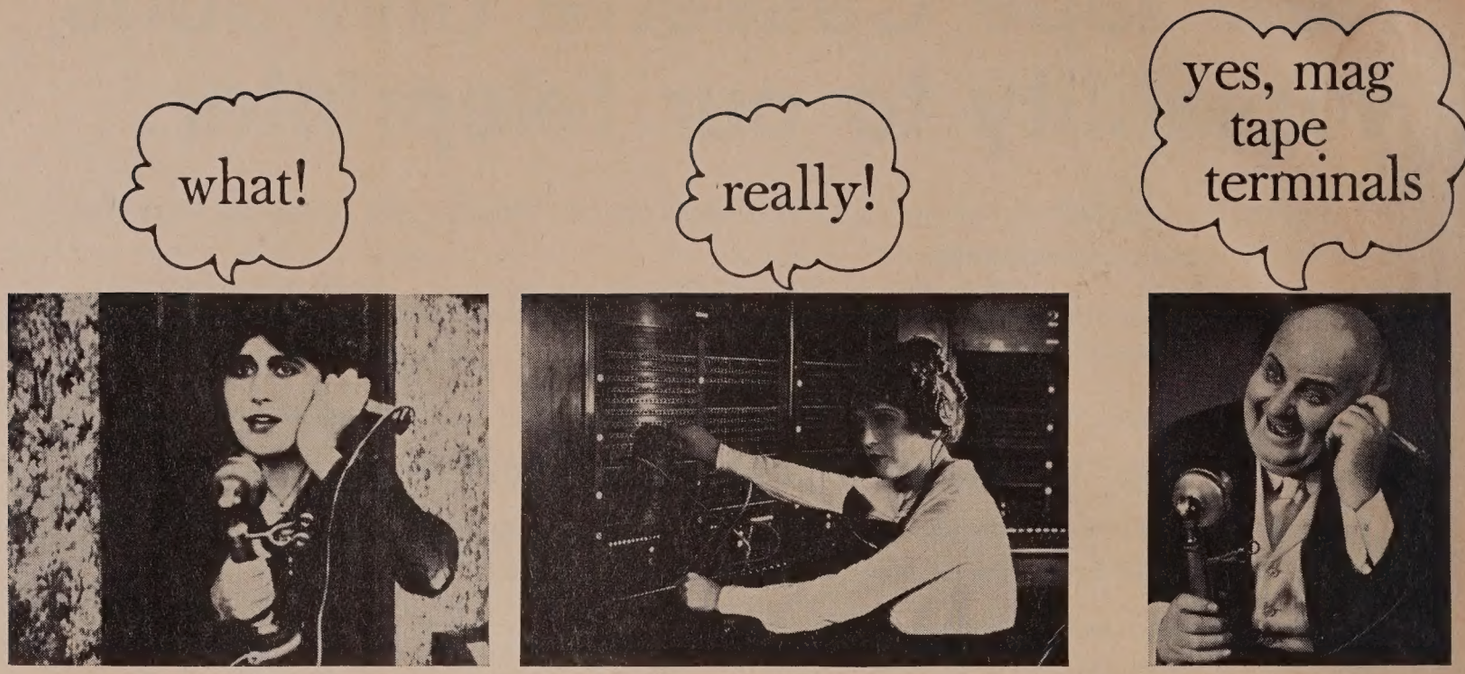
GENERAL ELECTRIC

INFORMATION RETRIEVAL NUMBER 13

TermiNet 300 (DATA COMMUNICATION PRINTER)

*Trademark General Electric Company, U.S.A.

Buffalo, N. Y. (716) 883-9210 Florham Park, N. J. (201) 377-0720 Lynchburg, Va. (703) 846-7311 (Ext. 429) Mt. Prospect, Ill. (312) 255-3200 Houston, Tex. (713) 771-5334
Portland, Ore. (503) 228-0281 Sacramento, Calif. (916) 927-0163 San Diego, Calif. (714) 297-2911 Waynesboro, Va. (703) 942-8161 Washington, D. C. (202) 393-3600

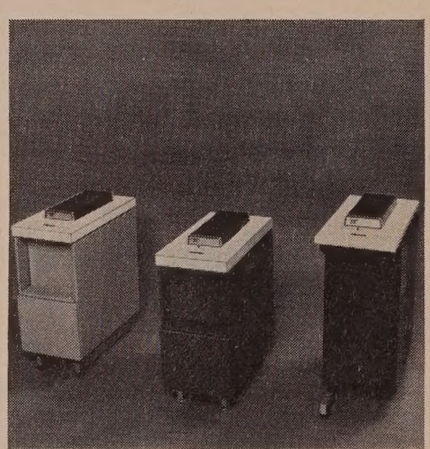


It's true.

After helping a jillion feet of paper tape wind and unwind its way through communications systems everywhere, Teletype announces the addition of magnetic tape data terminals.

There are some basic advantages in both mediums. But as you are well aware, the medium that's right for a system depends a lot on the application criteria.

The new magnetic tape data terminals have many operational features that make life less complicated for the operator.



New, modular line of Teletype® 4210 magnetic tape data terminals.

For example, take a look at the tape cartridge, which was specifically designed for reliability required for data transmission.

Its vital statistics are: 3″ x 3″ x 1″.

It contains 100 feet of ½″ precision magnetic tape.

It will hold 150,000 characters of data, recorded at a density of 125 characters per inch. The equivalent of a 1000 foot roll of paper tape.

This means that your data is easier to store, easier to handle, easier to work with than ever before. And it's reusable.

Teletype is a trademark registered in the U.S. Pat. Office.

Computer Decisions

DEPARTMENTS

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Cobol and BAL debugger

66 **Literature**
The subject is money

The cover:
Looking like an elementary school art lesson, this computer-generated scene is part of an animated sequence. The picture was generated on a General Electric graphics system. For the story behind the scene, see page 12.

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There are more ways than one to produce shaded pictures with computers. Here are the methods being followed by the "polygon school."
Theodor H. Nelson, The Nelson Organization

26 **IFIP '71: A meeting of East and West**
This year's IFIP Congress will be held in Ljubljana, Yugoslavia, August 23-28. If you're going, here's what to expect at the Congress, how to get there, where to stay and what to do after the Congress. If you can't make it, here's what you're missing.
Jeffrey N. Bairstow, Computer Decisions

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36 **Cut input costs with key-to-tape devices**
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James H. Bauch, Data Action Corporation

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Validating and editing input data in the mainframe is expensive. Key-to-disk systems allow users to save mainframe computer space and time by performing these functions off-line.
Barry M. Harder, Entrex Incorporated

46 **Key-tape/key-disk survey**
More than 40 different types of key-to-tape and key-to-disk source data entry systems are on the market today. A comparison chart of these units covers all of the important specifications that the potential user should know.

INFORMATION SYSTEMS AUTOMATED PROCESSING PROBLEM SOLVING VOLUME 3 NUMBER 5 MAY 1971

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Thomas W. Carr

Editor-in-chief:
Robert C. Haavind

Managing Editor:
Jeffrey N. Bairstow

Associate Editors:
Richard M. Laska
John C. Trifari

Art Director:
Cal Schoenfeld

Art Assistant:
Stephen Brown

Editorial Assistant:
Eunice Chee

Adv. Production:
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Circulation:
Nancy Merritt, Dir.
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Editorial Board:
Robert W. Bemer
Staff consultant,
Honeywell Information Systems Inc.

Kenneth S. Kretschmer
President,
Kretschmer Associates

Theodor H. Nelson
President, The Nelson Organization

Franklin F. Kuo
Professor of electrical engineering,
University of Hawaii

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Newsdata

New York's off-track betting—computer is no-show

While local government officials throughout the country are eagerly eyeing the apparent success of New York's off-track betting experiment, the computer system which is to be the heart of the operation is still not ready to take over.

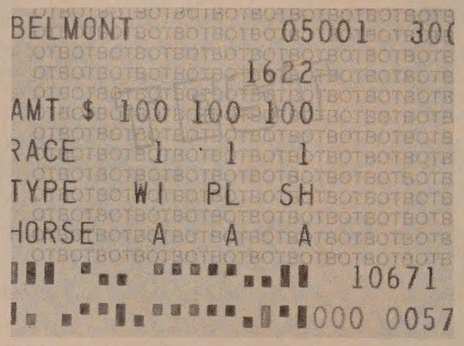
Edwin Brenman, director of municipal data systems for New York's budget bureau, notes that the system is presently undergoing final testing and will be at least partially operational by early June—more than six months behind schedule. "We are still not satisfied with the reliability of the system. We're now trying to cut restart time from 20 minutes to two."

As presently configured the system is, in the words of one city official, "relatively unsophisticated." If one of the two 360/50's used in the system should go down, restart entails reading all of the transaction data from the backup magnetic tape file onto the alternate system's disk storage, and then following restart procedures. The process could take up to a half hour, and would certainly not be popular among the long lines of people waiting to place their bets.

The wagering system is being developed for the Off-Track Betting Corporation (OTB) by Computer Sciences Corp. The terminals employed in CSC's unsuccessful "Computicket" venture are being used.

When asked why CSC and OTB failed to meet their November deadline for an operational computer system, OTB's Vice-President of Engineering Barry Mindes snapped back, "A question like that is stupid to anyone who knows about large computer systems. The technical people here have been working 100-hour weeks."

When the system finally becomes operational, it will have some impressive capabilities. With PDP-8's being used as front-ends, the network will handle up to 1,000 terminals. To facilitate rapid cashing of winning tickets, five digits of the 12-digit ticket number will be the disk address of the record of that ticket. The ticket will be printed with optically-readable hex coding so that it only has to be inserted into the terminal to have the payoff calculated.



This bogus betting ticket shows the code number of the ticket (right).

Computer exports rise, European info services fall

Exports of computer and peripheral equipment and parts rose to $1.1 billion in 1970, up 52% from 1969's total of $728 million. Imports of data processing machines increased even more significantly in 1970 to $43 million, which was 91% above the 1969 level. The figures were tabulated by the Commerce Department.

Major customers for U.S. equipment were West Germany, United Kingdom, France, Canada and Japan. Principal sources of import were Canada, Italy, France, Japan and the United Kingdom.

Meanwhile, reflections of the U.S. domestic computer business slowdown appear to be hitting in England. Andre Chargueraud, president of Diebold Europe, S.A., a consulting group, reported that an ICL spokesman (International Computers, Ltd. is the largest edp manufacturer in Europe) stated that his firm's computer orders have dropped 20% over the past five months.

Poor planning led to the downfall of a number of information services on the Continent as well, Chargueraud says. In France a sophisticated population file, and in Germany an interactive service bureau network, were among the casualties, with losses of some $1 million in each case.

ADAPSO vs. Banks: court case on edp sales

In a showdown on bank-offered edp services, ADAPSO and Data Systems of Minnesota will meet the American National Bank of St. Paul in Federal District Court on June 21. The bank is charged with illegal competition in offering edp services which, according to ADAPSO, have taken customers away from the independent service bureau. As one ADAPSO spokesman put it, "Whoever wins, the case will be appealed. This sort of thing could go on for years."

Three contenders for the computer memory title

Integrated circuits, charge-control devices and magnetic bubbles are likely contenders to challenge the dominance of core memories for main storage. Speaking at the recent International Magnetics Conference in Denver, Jack Morton, vice-president (electronics technology) at Bell Laboratories, tended to favor Bell's own magnetic bubble technology as the eventual winner, but he admitted that "the odds cannot yet be calculated in this high-stakes poker game."

"Core memory seems to be bottoming out," said Morton "and the cost of further progress looks high." Integrated-circuit memories have already appeared which outpace core in speed, he noted, and costs of less than 0.1 cent per bit can safely be predicted. Magnetic bubble 1000-bit shift register memories are routinely being made at Bell Labs and a 10,000 bit register has been developed that requires very little power. Costs of 0.01 cent per bit are predictable, claimed Morton. The third type of devices, charge-coupled semiconductors, also a recent Bell Laboratories development, hold the promise of even higher speeds than conventional integrated-circuit memories and magnetic bubble memories.

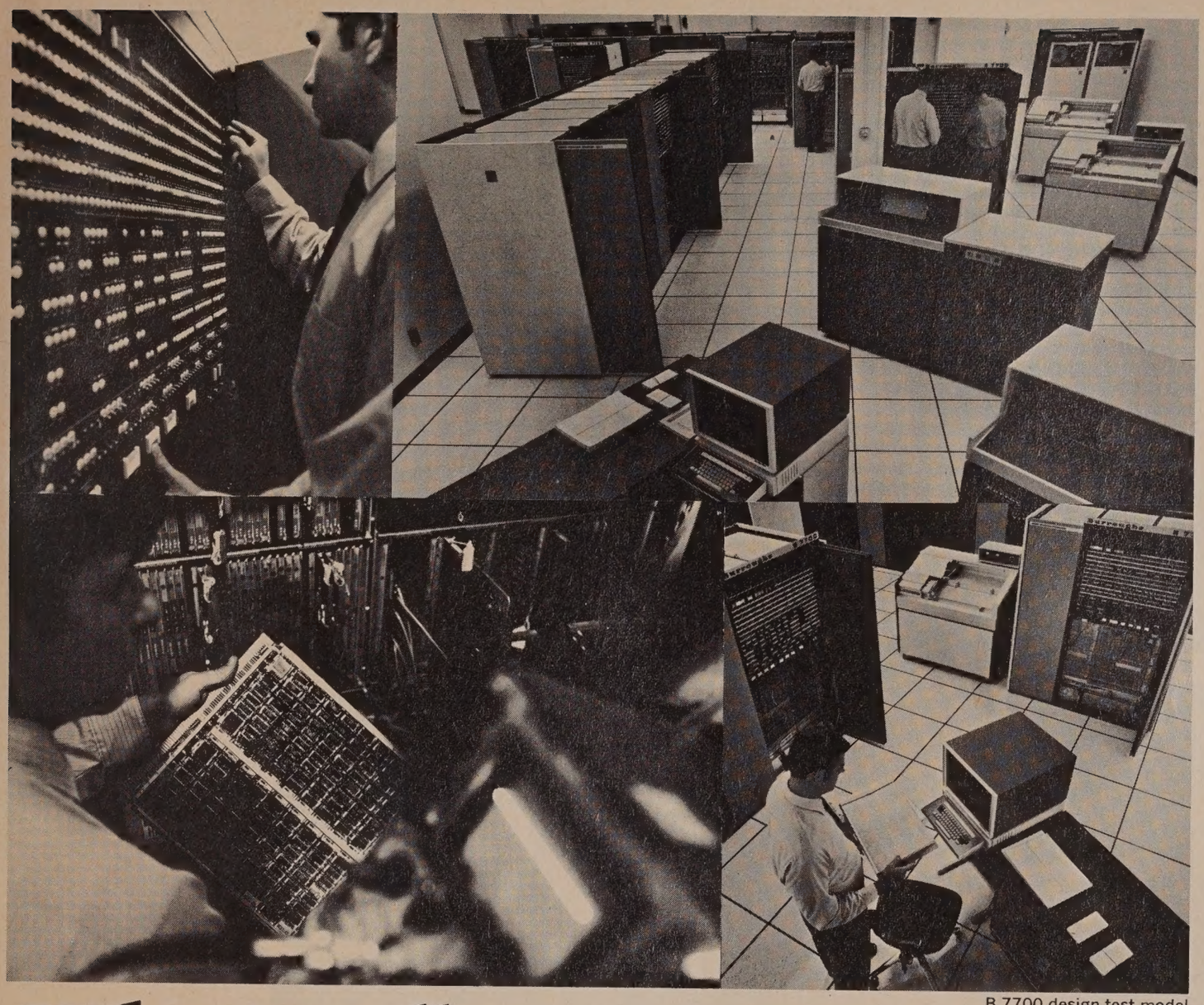
More evolutionary systems

Following the herd of evolutionary systems announcements comes Britain's International Computers with enhancements to their 1900 line. The new 1900S series consists of four systems, the largest the 1906S with a maximum memory size of 512k words (24-bit), and the smallest the 1902S with a maximum size of 48k.

ICL does not plan to sell directly to the U.S. domestic market. Hugh Osborn, director of international marketing, explained that ICL is aiming at U.S. companies with international operations or affiliates. "We may enter the U.S. domestic market eventually" said Osborn, pointing out that "the economic climate in the U.S. is not too encouraging at this time."

IBM's new look — OLD

The latest quotation from Chairman Watson of IBM comes from a memo dated March 26: "Too many of our (IBM) people are beginning to exceed the bounds of common sense in their business attire . . . (henceforth IBM managers will) establish and enforce conservative dress and appearance standards."



B 7700 design test model

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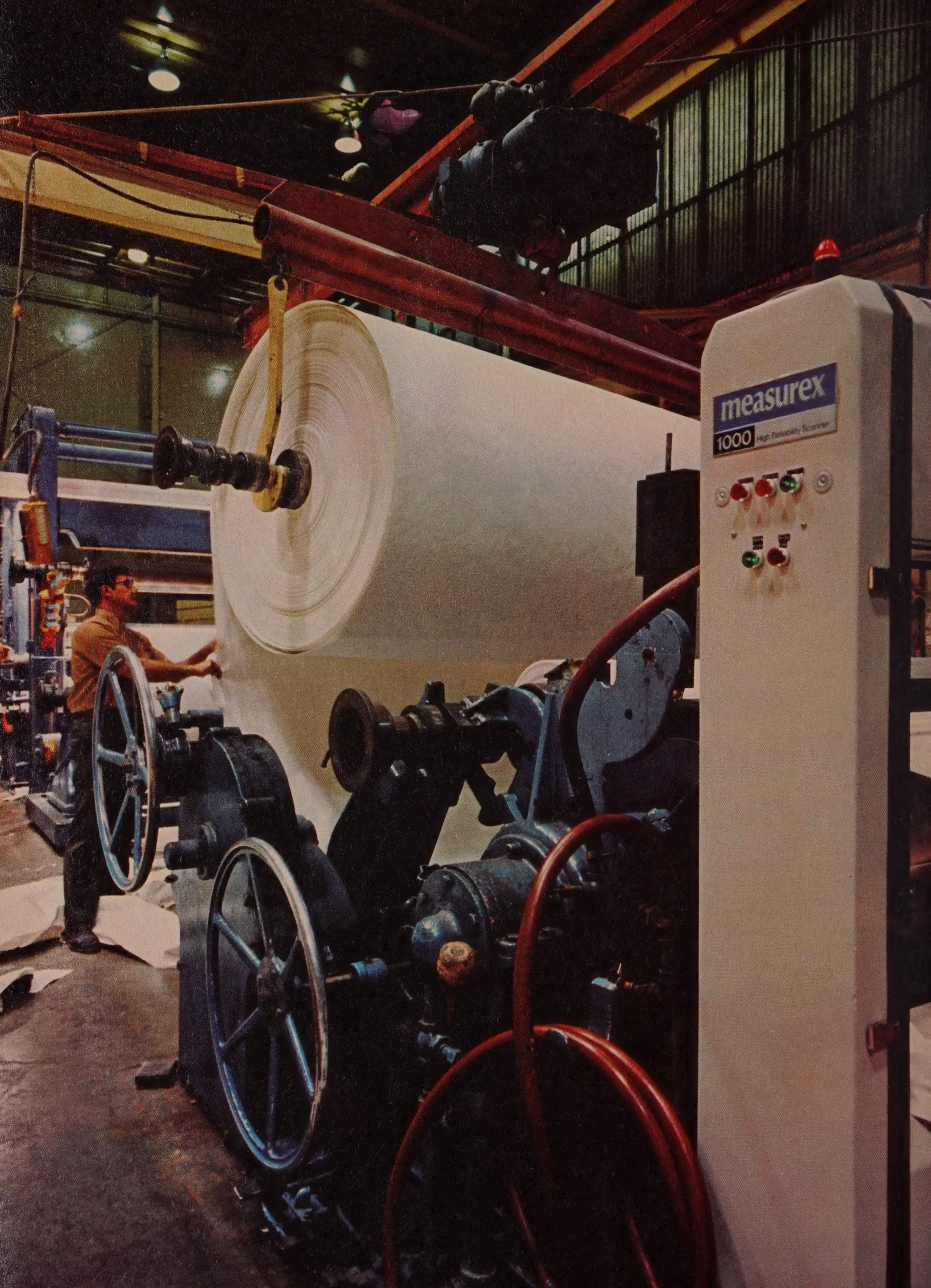

measurex
1000

A minicomputer here?

Sure! And ours is helping boost profits up to $20,000 a month.

Paper mills can be pretty rough on electronic equipment. So any computer system put there had better be able to take it — especially if it's guaranteed to increase profits. And Measurex of Santa Clara, California does just that. They guarantee profit increases from $4,000 to $20,000 a month.

That's one big reason why they chose our 2116 Computer as the heart of their paper mill process control system. They knew it would keep on working in spite of heat, humidity, vibration and corrosive fumes — acting as an on-the-spot control center in Measurex's unique system for regulating the moisture and fiber content of paper speeding along at hundreds of feet per second.

It's a job that affects profitability in a big way. Misjudging fiber or water content, even slightly, can be costly. But improved reliability and accuracy can pay off to the tune of half a million dollars a year in added profit. With so much at stake, it's not surprising that Measurex chose our computer.

There are other things to like about our small computers: good specs, comprehensive software and simple interfacing with all system components. Constant updating without obsoleting your present system. (Measurex will soon switch to our new 2116C just by plugging it into the old interfaces.) Plus our complete line of input/output devices, available off-the-shelf.

Another benefit: our minicomputers don't put the squeeze on an OEM like Measurex — or any other purchaser. For instance, you can now buy our new powerful 2116C, with up to 32K of core memory — all in the mainframe — for just $50,000. If you don't need that kind of power, our 4K version of the 2114C costs just $8500. And we've doubled the memory of this computer, too. So you can now get a 16K version for $22,000.

Get the full story on computers you can depend on. Call your nearest HP sales office or write to Hewlett-Packard, Palo Alto, California 94304; Europe: 1217 Meyrin-Geneva, Switzerland.

INFORMATION RETRIEVAL NUMBER 6

HEWLETT hp PACKARD

DIGITAL COMPUTERS

22021

Washington Datalink

by Jerry Boyd

HOUSE GROUP TO PROBE WALL STREET AND INVESTIGATE BACK-OFFICE SYSTEMS

If the barons of Wall Street aren't running scared, they should at least be looking over their shoulders with some apprehension. John Moss is on their trail. Moss, Democratic congressman from California, is chairman of the House Commerce Committee's subcommittee on Commerce and Finance. He is in the process of gearing his subcommittee up for an all-out investigation of the stock brokerage business and its problems—including the contributions to the failures of some firms made by ill-conceived or improperly operated computer systems.

Moss: quiz brokers

The Legislative Reorganization Act adopted by the House last year requires that a congressman can hold the chairmanship of only one subcommittee at a time. This forced Moss to give up his leadership of the Government Operations Committee's subcommittee on foreign operations and government information. It was in that role that Moss developed a reputation as a head-knocking, toe-stomping bane of bureaucrats, several of his House colleagues—and three Presidents. One Moss probe turned up a scandal involving the theft and sale of U.S.-furnished military supplies in Vietnam; another resulted in passage of the Freedom of Information Act, stemming from a crusade he began during the Kennedy Administration, aimed at preventing government officials from hiding information from the press and public. Presidents Kennedy, Johnson and Nixon all suffered Moss' blasts against government secrecy—and all eventually had to give in.

After several brokerage houses went bankrupt last year, carrying down the drain with them the investments of many of their customers, Congress established the Serurity Investors Protection Corporation. This will operate somewhat like the Federal Deposit Insurance Corporation, which protects bank savings accounts. When the legislation was adopted, Chairman Harley O. Staggers (D.-W. Va.) of the Commerce Committee promised that a complete investigation would be made of the stock brokerage business. He gave the job to Moss. The probe will take up to two years to complete. "We're going to look at everything," a staff member said. "Commission rates, back office problems, the whole range of practices in the business."

Another committee staff member said that among other things the subcommittee would study is what computers are being used to handle stock market transactions and other paper work; and what sytems can be used that aren't. "We know that some firms went broke because they did put in computers. They listened to fast-talking salesmen who promised their computers would solve all the problems. They put them in without a trial period backed up by the manual systems. And they used unworkable programs and untrained personnel."

ROUGH ROAD AHEAD FOR MINICOMPUTER AND PERIPHERAL MAKERS, SAYS COMMERCE

Independent peripheral manufacturers and minicomputer companies face rough going in the 1970s, according to the Department of Commerce. But the computer industry will show a healthy 11 percent growth this year, with mainframe shipments totaling $4.2 billion, and will continue to grow through 1980 when shipments will reach $10.2 billion.

The department predicted that many independents will be undone by what it called "the trend toward consolidation (as mainframe and peripheral manufacturers strive to generate across-the-board capability in hardware and software) — the total systems concept." Many manufacturers will be unable to find enough capital to market and service expanded product lines.

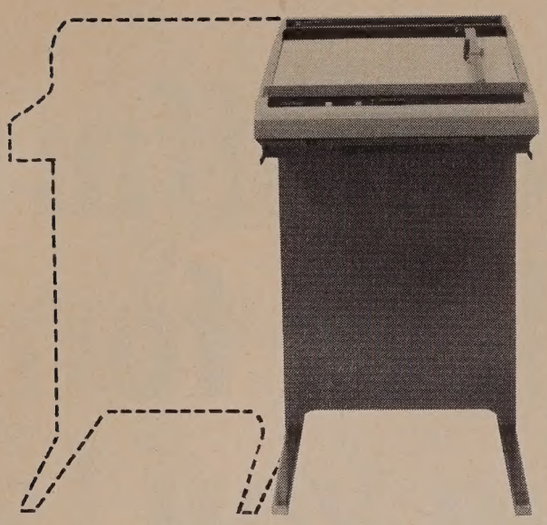
The ranks of minicomputer manufacturers will be reduced through retrenching, mergers and bankruptcies, the department said. But the market will be good for those who are left. Shipments will increase 15 to 25 percent a year into the mid-70s.

Computer buyers may get a break if the department's predictions of "fierce competition" between IBM and the minicomputer makers, and modification of the IBM "price umbrella" comes true. "Future prices may decline even further as a result of recent IBM peripheral equipment price reductions," the department said. The comments are contained in a Commerce Department Report, U. S. Industrial Outlook 1971, available from Commerce Department Field Offices or the U. S. Government Printing Office Washington, D.C. 20402 for $5.

MANUFACTURERS SEEN RESPONSIBLE FOR PROVIDING ADEQUATE DATA SECURITY

IBM and Honeywell both went on record at the recent Senate hearings on computers and constitutional rights as favoring the development by computer manufacturers of data security techniques. Nicholas DeB. Katzenbach, IBM vice president and general counsel, agreed with Robert P. Henderson, vice president of Honeywell Information Systems (COMPUTER DECISIONS, April, 1971), that manufacturers have the responsibility for providing technology to keep information secure. "But while one can build locks," Katzenbach said, computers do not decide who should be given the key and how he uses the information."

In the meantime, Rep. Cornelius E. Gallagher (D.-N.J.) introduced what will probably be the first of many bills aimed at protecting individual privacy from the dangers of computer data banks. Gallagher's bill would make it illegal for commercial income tax preparation firms to disclose any information without the consent of the taxpayer. Gallagher said he hoped the bill will start a movement "to have our law become responsive to the special threats of computer technology."



Picture your terminal (even if it's IBM) with our $3,300 graphic plotter.

At last, everybody can see their time-share data plotted in smooth, clear graphs. Hewlett-Packard's Model 7200 Graphic Plotter will add a new visual dimension to any terminal in the business. Now, even if you're partial to IBM's 2741, you can have instant graphic solutions to every type of engineering or mathematical problem.

There's no special operation or programming knowledge needed. You control the program. Plot numerical data in points, lines, curves, circles, ellipses, bar graphs or pie charts. Or, manipulate and expand computer data and plot in finished graphic form. You get smooth lines—not the staircase drawn by the incremental recorder.

Use the HP 7200 simultaneously with your time-share terminal or silence the terminal and use the plotter alone. Because it goes to work when the data comes in, there's no time lag.

Simple manual controls allow you to set the graph limits to fit any pre-printed grid. HP's Autogrip electrostatic holddown firmly grips any graph paper up to 11x17 inches.

You can arrange to add a graphic plotter to your existing time-share terminal by contacting Hewlett-Packard. Buy it at $3,300. Rent it. Lease it. Or lease to buy.

We can match a 7200 with any EIA ASCII terminal in the business . . . or even IBM's 2741. So now, everybody can be the arty type. For details, contact Hewlett-Packard, Palo Alto, California 94304; Europe: 1217 Meyrin-Geneva, Switzerland.

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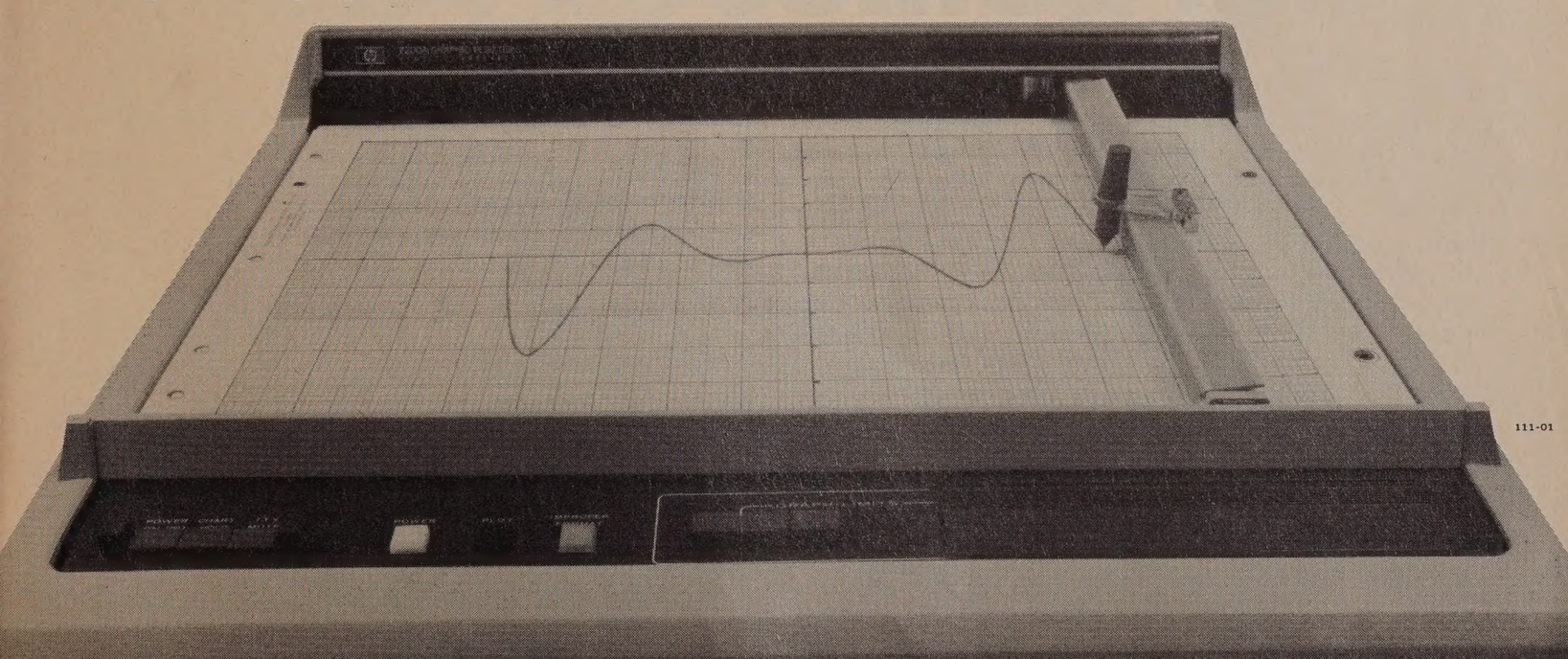

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SYNER-DATA

Kurt Dexter, Director of Marketing for Syner-Data presents the case for high reliability in low-cost line printers.

For complete information on the Syner-Data ALPHA Series write Kurt Dexter, Director of Marketing, Syner-Data, Inc., Route 128, 133 Brimbal Ave., Beverly, Mass. 01915. Telephone: (617) 927-3222. In Canada, Syner-Data Canada, Ltd., 367 Ormont Dr., Weston, Ontario. Telephone: (416) 742-7804.

INFORMATION RETRIEVAL NUMBER 37

Virtual memory is the trend of the future. RCA's new computers have it. IBM's don't.

Virtual memory. A lot of people are talking about it, asking for it, and getting it.

But not with an IBM 370. They don't have it.

RCA has it. We've had it working for some time now. Working so well we put it in our new computers. RCA 3 and RCA 7.

RCA pioneered in virtual memory. But what does that do for you?

Virtual memory makes a computer work as though its memory were unlimited.

Which means it's hard to outgrow. And one of the main reasons most 360 users have to move to larger, more expensive computers is that they outgrow memory.

An RCA computer with virtual memory can do the work of a larger IBM computer with regular memory.

And work on more kinds of things. You can do regular batch jobs at your computer site, pipe work in from across the country, and put your people on time sharing terminals—all simultaneously.

With all that capacity, our virtual memory RCA 3 and RCA 7 are highly efficient.

Many regular memory systems get bound up by lack of memory and so don't work at full efficiency.

35% of the orders for our new RCA series are for computers with virtual memory.

It's practical right now.

RCA 3 is about half the price of any previous virtual memory system.

RCA 7 is equal to or better than IBM's regular memory 370/155 in price/performance, and has sophisticated time sharing capabilities the 155 doesn't have.

Virtual memory is the future of the computer business. A lot of people already need it. So we're making it. For you. Now.

RCA
COMPUTERS

INFORMATION RETRIEVAL NUMBER 38

Computer Decisions

PERSPECTIVE

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Bring us all together

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Automatic documenter

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8 Portable terminals: you can take it with you when you go

Whether you want printed copy, crt display, or voice response, portable terminals give you computer power in a briefcase. Included is a critique of each type of terminal along with a survey of those presently available.
Richard M. Laska, Computer Decisions.

16 No more teachers' dirty looks

Teaching by computer does not make the process scientific. In fact, the computer may prove as much of a block as a teacher. The important point is for the student to become involved so that our children may develop the minds we should have had.
Theodor H. Nelson, The Nelson Organization.

28 Be mean about management reporting

Rather than deluging the hapless manager with reams of computer printout, an information system should only provide reports when situations exceed certain limits. These 'exception' reports can be derived from control charts like those used for quality control.
Norbert L. Enrick, Kent State University.

34 Minicomputers speed automation on the factory floor

The ubiquitous minicomputer has found its way onto the assembly line where it is being used for the control of fabricating machinery. Flexibility and decreased costs can result from using minis rather than the conventional hard-wired controller.
Stephen J. Fryer, General Automation, Inc.

Maxi to midi: new look for COMPUTER DECISIONS

With this issue, COMPUTER DECISIONS becomes a standard-size magazine, in response to the requests of many readers. The editors would like to know your views on the new size, format and editorial content, so why not take a couple of minutes, after reading the magazine, to fill out the postage-paid Reader Reaction Card inserted at the top of this page?

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Jeffrey N. Bairstow
Senior Editor:
John W. Sutherland
Assistant Editors:
Richard M. Laska
John C. Trifari
Art Director:
Cal Schoenfeld
Adv. Production:
Tom Sedita, Manager
Berni Wolinsky, Ass't.
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Nancy Merritt, Dir.
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Manager, systems and software integration, General Electric Co.
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Professor of electrical engineering, University of Hawaii
Paul D. Oyer
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Jack Quillman
175 San Antonio Rd.
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newsdata

Computer expert named Presidential Advisor

Dr. E. E. David, Jr., an expert on computers and communications, has been appointed Science Advisor to President Nixon. Previously, Dr. David was executive director of communications systems research at Bell Telephone Laboratories, Murray Hill, N.J. Dr. David is also a COMPUTER DECISIONS author (see 'Soviet Computing,' March 1970).

Dr. David is taking up his role at a time when the scientific community is protesting strongly about budget cuts for research and development. It is not known whether Dr. David might play a stronger part in this issue than his predecessor, Dr. Lee A. DuBridge. Dr. DuBridge, 68, resigned because he "had a horror of staying in any job beyond a reasonable retirement age."

Suit against IBM settled out-of-court for $1.4M

Applied Data Research Corporation, Princeton, N. J., and IBM have announced an out-of-court agreement on ADR's anti-trust suit involving one of its proprietary software packages. Under the terms of the agreement, ADR will dismiss its pending suit against IBM and will release the company from any claims; IBM in turn will reimburse Applied Data Research $1.4 million, for certain costs incurred in connection with the suit.

At the same time, it was announced that the two companies are studying a proposal by which Applied Data Research would supply IBM with its Autoflow software package for $600,000 payable over a three-year period. "This however, is not part of our settlement with IBM," stated John R. Bennett, president of ADR, adding that "we are quite satisfied with the settlement with IBM, and we now have a nice business arrangement going."

Viatron lays off 135; gets $250,000 order

Troubled Viatron Computer Systems Corp., Bedford, Mass., announced that 135 more employees had been laid off, leaving a total of 365 still on the payroll as opposed to close to 1,000 last May 1. At the same time Charles Morrill, director of corporate affairs, stated that the company had received a $250,000 order for its System 21 data entry equipment from an unnamed utility.

Morrill noted that the lay-offs were an "across-the-board lay-off, and were designed to reduce operating expenses."

Earlier he flatly denied rumors that the company was in the process of discontinuing all hardware manufacturing and concentrating solely on the production of MOS circuitry.

Morrill also noted that Viatron's OCR line announced at SJCC would not be available for delivery in September as announced.

UK imports of edp gear to hit $650m by 1975

Imports of computers and related equipment to the United Kingdom are expected to rise from $166 million in 1970 to $650 million by 1975 according to a study recently published by the US Department of Commerce.

The study predicts an excellent market in the UK for small and large machines although not for medium-scale systems, mainly because of the competition from the local manufacturer, International Computers Limited. Peripheral imports are likely to show the greatest growth, says the report, particularly in the area of data transmission. The study is not quite so optimistic about software packages, pointing out that, even with the upcoming decimalization of British currency, there are still considerable differences in accounting procedures.

Copies of the report, Electronic Data Processing—United Kingdom IMIS 70-214) are available from the US Department of Commerce, Washington, D. C. 20230, (10¢).

Another committee for computers in Congress

Late this month the House is expected to begin wrangling over a proposal to create a Joint Committee on Data Processing to oversee computer use on Capitol Hill.

The proposal is included in Title 3 of the Legislative Reorganization Act, which the House began debating in mid-July. The House Rules Committee, which reported the bill and strongly endorsed the Data Processing Committee plan, said the House would resume debate on the entire bill immediately after its recess ends September 15, taking up Title 2. The committee spokesman expected the Title 2 debate to move quickly and the data processing portion to come about a week later. Hill leaders expect House approval of the Data Processing Committee although no head-count has been undertaken.

Money for minis

Ten colleges have received grants from the National Science Foundation to evaluate the educational impact of mini-computers. Grants totalling $398,400 were awarded and the participating schools are contributing about $723,000 to the three-year experiment.

Each school will shop for its own computer among general purpose systems costing $12,000-$75,000. The schools, widely distributed geographically and differing in educational emphasis, share a problem common to many colleges—the need for computing facilities to permit academic instruction in computer use.

We hear . . .

. . . that a special investigating subcommittee of the House Armed Services Committee is secretly probing worldwide defense communications of all services. The panel is composed of Rep. Robert H. Mollohan of West Virginia and Rep. Durwood G. Hall of Missouri.

. . . the Bell System is to issue a booklet giving detailed specifications on the telephone network. Should be a great help to many users and to companies designing attachments to the telephone system. . . .

You be the judge

The facts in the case are clear. BASF's new disk drives provide significant advantages over those offered by the industry giant.

FACT: They have faster access times (up to 50% faster).
FACT: They have simpler, more advanced, more reliable design.
FACT: They are delivered in about 1/3 the currently quoted time.
FACT: They are considerably lower in cost.

Of course, they are completely compatible with the System/360. The BASF Model 111 interchangeable with the 2311 . . . the BASF Model 1014/114 Disk Storage Sub-System interchangeable with the 2314 System. The BASF Model 1014 Controller permits on-line use of up to eight 114 Drives and one spare drive.

Get ALL the facts — call or write for new disk drive data and brochure. Then, *you* be the judge.

BASF

BASF SYSTEMS INC

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1313 West 8th St. Suite 129, Los Angele 213-483-8453

INFORMATION RETRIEVAL NUMBER 3

LETTERS

Beat this, PL/I-haters

Lois Frampton's article, "How does PL/1 compare with its forebears?" (May) was excellent. The responding letters (July) show for the most part only that their writers did not read Mrs. Frampton's article carefully, or that they simply bear strong grudges against anything connected with IBM.

There is one feature of PL/1 which I am sorry Mrs. Frampton did not mention in her article. That is the preprocessor stage. It is a language feature in which the compiler edits the text of the source program immediately prior to compilation (i.e., the full source text is scanned and edited as required, and then the edited text is compiled.) This greatly enhances the power of the language. One might write a program directly in French (for example, using FIN wherever an Englishman would write END) and still make it perfectly acceptable to the compiler by including the proper preprocessor statements to accomplish translation. (The single instruction: % FIN='END'; would account for all occurrences of FIN in our example, after having declared FIN to be a preprocessor variable.) As another example, one might write a very generalized application program with many many features, each of which is used on only relatively few actual program executions. In other languages this would, most likely, be a very inefficient program when executed. But the preprocessor stage of PL/1 can be utilized to tailor the program specifically to the exact requirements of a given run by deleting unused portions of text, translating other portions and inserting new values of variables, and expanding or adding new text. The compiled program can then be a very efficient one suited exactly to the requirements of the particular execution.

As a challenge to all the pessimists, I'll make the following offer. I'll pay $100 personally to anyone who can duplicate or surpass in any other language the features I have been able to build into a time-sharing data retrieval and reporting system implemented with PL/1. It speaks English with its user, provides error diagnostics and recovery at the terminal during execution, can produce any one of over a thousand different management reports given only the desired report number, allows output format changes during execution, will produce a given report in units, dollars, pounds, lire, francs, or any other currency on command, automatically justifies column headings, rounds and keeps track of its own data files, among other things. I'll be glad to send a full write-up to anyone who requests it. Any takers?

Joseph W. Schmitt
Glen Ellyn, Ill.
Circle information retrieval number 118 for Mr. Schmitt's write-up.

ACM-DPMA merger?

Sir:

Your editorial in the 1970 June issue is timely, and I agree enthusiastically with your arguments. *(The editorial suggested that the "get-things-done" people in the computer field should coordinate their efforts.)* However, one seldom writes a letter to the editor to praise him unless he has a "but", and I do.

By logical inference, you are saying that I belong to the "slightly more commercially oriented group" *(within the* ACM*)*. You then say that "even this group does not feel that people like (DPMA) are really at their level."

This is not consistent, for I am a member of DPMA as well as of ACM. I spoke to the recent Seattle meeting of DPMA (at the expense of much time out from the ACM 70 activities to write my paper), and exhorted them to persuade Calvin Elliott to name a formal representative to the National Computer Year Planning.

Furthermore, as a member of the ACM Council I was the first to propose a formal merger with the DPMA, somewhere about 1963.

R. W. Bemer
Manager, Systems and Software Integration
General Electric Co.
Phoenix, Ariz.

Editor's reply: A few more Bob Bemers and the industry would really get on the track! What about that DPMA - ACM merger? Some of our member-readers may have some pertinent comments. They will be forwarded to the officials of the respective societies.

Standards for shipping data

Sir:

Congratulations on the Voice of the User on standards by Thomas B. Steel in the July issue. I should like to bring to your attention the national programs for data uniformity that are being carried out by the shipper/carrier/banking and government community through the Transportation Data Coordinating Committee.

The Transportation Data Coordinating Committee, 1101 17th Street, NW., Washington, D.C., has been established as a non-profit organization of shippers, rail-motor-ocean-air-barge carriers, forwarders and banks to save the transportation industry which has become inundated by non-compatible, costly and delaying paperwork. Seven major task forces of industry and government are deeply involved in developing and fostering the codes, formats and systems which will permit external communication of data by computer throughout this vital sector of the nation's economy.

Edward A. Gilbert
President
Transportation Data Coordinating Committee,
Washington, D.C.

Support the FCC

Sir:

During the 1960's, the computer industry and communications moved toward a confluence to create a new industry — computer/communications. But the innovation of the computer industry has not been matched by innovation in common carrier services.

The common carriers have continued to concentrate their efforts toward providing better service in their areas of communications monopoly—telephone and telegraph services—and have failed to meet computer users' needs. As a result, new communications companies have sought to provide new, specialized common carrier services. The FCC has recommended the entry of specialized common carriers and stated that competition will give computer users lower communications costs, will encourage specialized services required for data transmission, and will create growth of communications-oriented computer applications.

In issuing this landmark staff position, the FCC asked for comments by all interested parties. These comments can simply be letters from communications and computer professionals expressing their views on the issue of competition in communications. Why not write a letter to Ben E. Waple, Secretary, Federal Communications Commission, Washington, D. C. 20554. State that you support the Common Carrier Bureau position on specialized common carriers.

Calvin C. Morrell
Manager communications and data collection
Continental Can Co., Inc.
New York, N.Y.

You've gone computer. You've given it a good try. Now you're disenchanted. You're unhappy about the costs/results ratio.

You've also got lots of company.

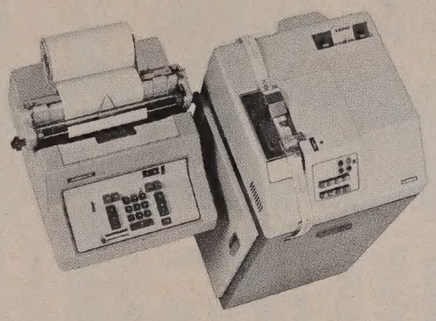
If yours is a typical situation, it's the most common problem in data processing—and the problem is *not* the computer.

The bind comes with the excessively high cost of data capture and control: input preparation. And perhaps worst of all, those high costs discourage the implementation of many useful programs. So full use of the computer isn't even being made. (It's like keeping a fine car in the garage because the fuel is too expensive.)

But the gathering of data for computer processing need not be costly or complicated.

With the Addo-X system, data is prepared automatically, in computer-acceptable form, *as a by-product* of normal accounting, reporting, and record-keeping operations. Keypunching is eliminated (count *those* savings for openers). So are error-correction and data-verification costs.

It's as easy as operating a 10-key adding machine. With only an hour or two of training, any member of your office staff can turn out computer-ready input. No extra procedures, no extra personnel, no extra payroll costs.



And no errors—because this is a *programmable* method. Procedural errors are impossible; they're actually caught before they happen. (If the operator makes a mistake in the assigned procedure the machine simply locks. No entry, thus no error.)

Many companies of every size are profiting right now from the economical Addo-X system. All it takes is a brief review to see how it can serve you too. And all that takes is your call or note now.

Addo-X, Inc., ADP Division, 437 Madison Avenue, New York, N.Y. 10022 • (212) 758-9171.

ADDO-X

If your computer looks like a lousy investment, don't blame your computer.

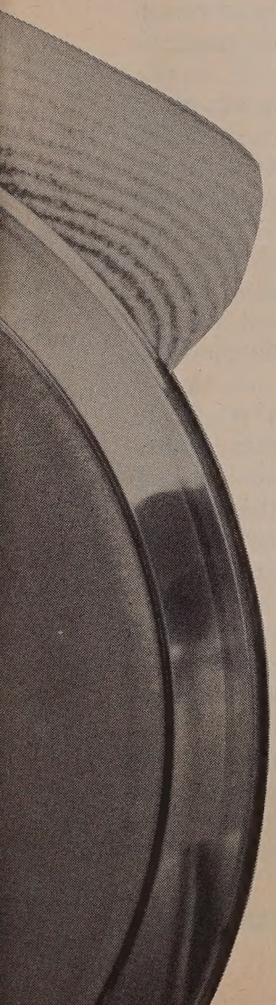
Your data preparation methods are probably obsolete.

Regional headquarters: 6549 W. North Ave., Oak Park, Illinois 60302/3339 Temple St., Los Angeles, Calif. 90026

INFORMATION RETRIEVAL NUMBER 4

The name makes a in disk

on the label difference packs.



When the name on a disk pack is "Scotch" Brand, it comes from the world's most experienced producer of magnetic computer products.

It's a product of the pioneers who gave the EDP industry its first computer tape.

It's made by the same people who have made virtually every major technological breakthrough in magnetic media.

You can expect "Scotch" Brand Disk Packs today to be unsurpassed in reliability and performance. And when the next advance comes in disk packs, you can expect it to come from 3M.

"SCOTCH" IS A REGISTERED TRADEMARK OF 3M COMPANY.

3M COMPANY

The barrier breakers.

INFORMATION RETRIEVAL NUMBER 5

Portable terminals: you can take it with you when you go

by Richard M. Laska
Assistant Editor

With their cables, plugs, printers and storage units, computers are anything but portable. But computer power is. Along with the growth of timesharing has grown the need to be able to communicate with the computer from remote and varying locations. Portable terminals are now available which offer the user a data entry keyboard plus all three popular means of computer output: printed page, crt display, and voice response. All the user needs is a telephone and, in most cases, an electrical outlet.

Portable terminals can do almost anything that a small stationary terminal can do (except accurate plotting), but they are slower due to the limited capacity of the telephone lines through which the data is transmitted. Originally developed for use by salesmen of timesharing services, portable terminals were needed to demonstrate services to prospective customers. The first terminals were basically teletypewriters weighing over 60 pounds and requiring two suitcases to carry. Despite these handicaps, robust young programmers took to lugging these terminals home to work out the day's programming problems.

Fortunately for the user, portable terminals no longer require herculean strength to carry about. The teminals covered by this survey range in weight from five pounds for a voice response terminal to less than 50 pounds for a heavy portable printer. For the purpose of this article, only those units which are complete within themselves are considered "portable terminals." For example, some "portable video terminals" require a standard television set for display, and tv sets are not always available where the user wants a portable terminal. Strip printers are excluded because of their severely limited flexibility.

How much is portability worth to you?

The first question to answer when considering the introduction of portable terminals is: When does it make economic sense to provide personnel with these units? There are five basic conditions which can be used to justify portability:

- Interaction with the computer is to be performed outside a permanent location.
- The nature of the application does not require high volume or high speed input or output.
- A high value is placed upon interacting with the computer.
- A short turn-around time between the input of data and the reception of the response is critical.
- The processed output carries a high value.

The most obvious area of application which might satisfy these conditions is a company's sales force. Salesmen can use their portable terminals to check inventory, record orders, obtain complex fee schedules (such as in insurance), and, at the end of the day, submit their expense reports. Such instant, in-the-field interaction not only provides the sales force with a much more dynamic sales tool, it also gives management up-to-the-minute reports on sales progress and more effective control over its salespeople.

For most applications, portable terminals are more expensive than stationary ones. However, in some situations, portable units can actually save money. Where access to a computer is required from many different locations within a company, a multitude of fixed terminals would be economically impractical. For example, through a portable terminal a doctor in a hospital could query a patient's medical record without needing a terminal in every room. Only a telephone is needed.

Another area where portable terminals might be useful on a more limited basis is to provide greater flexibility for a company's engineering, designing, and programming staff. A portable terminal for these highly skilled and expensive personnel would allow them to "take their work home" should they become deeply immersed in a project or run too close to a deadline. The intangible benefits of such a capability are extensive in terms of employee creativity and satisfaction. Also, the second-and especially third-shift computer time is much less expensive than first-shift time.

Once the decision has been made to employ portable terminals, the next question to be resolved is the matter of hardware: what kind of portable terminals best fit a company's applications? Basically there are

Whether you want printed copy, crt display, or voice response, portable terminals offer you computer power in a briefcase.

three types of terminals — page printers, voice response units and cathode ray tube (crt) displays.

Terminals that print hard copy

For those applications requiring hard copy, portable page printers are available which print out data on a roll of paper. These printers, descendants of the Model 33 Teletypewriter and therefore Teletype-compatible, are the most common portables in use today. Page printers use two different methods to produce characters: impact and thermal. Impact printers produce multiple copies and use ordinary paper. Examples of this type of portable printer are those manufactured by Tracor Data Systems, Inc. and the Stelma Division of Data Products Corp.

Electrostatic or thermal printers require special paper which costs about three times as much as standard paper. These printers do not produce multiple copies. Electrostatic or thermal printers such as those manufactured by Computer Transceiver Systems and Computer Devices are generally quieter than impact printers, faster — (15 to 30 characters per second versus 10 to 15 for impact printers) — and have less moving parts, thus subject to less maintenance problems. The weight of portable printers varies from 20 to 50 pounds. Acoustic couplers are built into most printers; in some instances the acoustic coupler is separate. A few manufacturers such as DataTerm and Electronic Information Systems, Inc. are modifying ordinary electric typewriters and supplying acoustic couplers built into the carrying case. The result is a heavier but cheaper portable terminal — approximately $1,000 versus $2,000 to $3,000 for the high quality impact printers.

One criterion for choosing an impact over a non-impact printer is the need for multiple copies. While it is generally not practical to print forms on a teleprinter, nevertheless there are occasions when multiple copies are required. For example, where a record of a transaction must be distributed to several people, or where it is necessary to show work completed.

The deciding factor in choosing page printers over either crt displays or voice response units is the need for hard copy. Therefore, the important issue to determine is: when is hard copy necessary?

- When the nature of a transaction is so complicated that reference to hard copy is desirable.
- When a record of a complete transaction is required the first time through because it would be uneconomical to regenerate the output. (This situation arises when the user does not have easy access to the computer).
- When further useful work can be done with the hard copy without additional communication with the computer.
- When it is desirable to leave a copy of the transaction.

However, sometimes hard copy is not as useful as might be expected. For instance, where many corrections have been made on the copy, the user may not want to leave it behind as a record. This problem of "messy copy" is caused by the page printer's limited editing features. Page printers cannot correct mistakes in the copy, but this capability can be programmed into the host computer. If a mistake is made, the user can type a special symbol, which appears in the copy, to inform the computer to delete the error. The user then retypes the correct message.

If the user requires error-free copy, software can be developed which instructs the computer to transmit the entire message, free of errors, when the transaction has been completed correctly. Or, this corrected version can be printed on a high-speed printer at the computer center and then mailed to the user.

Computer software gives the user of portable page printers additional capabilities. Software enables the computer to print out data in orderly columns for pricing schedules or tables. To aid in formatting, software can lay out a form in the computer's memory so that the computer will ask a prescribed set of questions to be answered by the operator. Of course, a penalty is paid in transmission time and software complexity for the computer to ask the questions, obtain the answers, assemble all the data and print out the entire form. The system is controlled by the nonprinting control keys on the page printers. These control keys do not produce visible marks on the copy, so an error in their use can go undetected. Software or clearly designed keyboards can alleviate this problem.

You need more than just a terminal

Besides the printer terminals themselves, other equipment is necessary for a full teleprocessing system. Along with modems and modem interfaces of appropriate speed and data format, a communications interface to the computer is required which must be able to handle a number of phone lines. For instance, a company with 50 salesmen in the field might require the ability to handle three terminals simultaneously. Extra capacity, although expensive, is important to keep the salesmen from encountering too many "busy" signals.

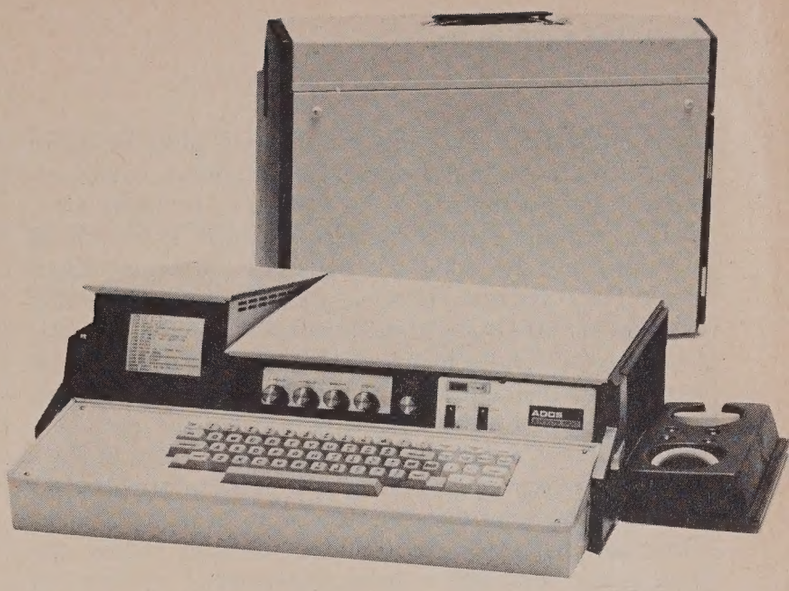
In addition, the teleprocessing system requires software compatible with the portable printers selected. Generally, Teletype software available from the manufacturer will serve this purpose. The company's applications programs also must be developed. Other costs would involve the additional core memory and peripherals. This increase in computer hardware might be as much as double that necessary for a standard batch processing system.

Fact sheet: portable printer terminals

Manufacturer	Model	Weight and Size	Print technique	Print speed (cps)	Character set ASCII	Line length (char.)	Features: ac = acoustic coupler pc = parity check nkc = numeric key cluster pi = peripheral interface	Price and Lease	Information retrieval number
Computer Devices, Inc. 10 Sonar Dr. Woburn, Mass. 01801 (617) 729-7436	1010	25 lb. 18x14x6	impact	10	send - 128 char. receive - 64 char.	80	ac; pc (odd or even)	$2,100	201
	1030	25 lb. 19x14x7	thermal	10,15,30	send - 128 char. receive - 64 char.	80	ac; pc (odd or even or none)	$3,600	202
Computer Transceivers Corp. 317 Rt. 17 Paramus, N.J. 07652 (201) 261-6800	Execuport 300	30 lb. 18x18x6	thermal	10,15,30	96 char.	80	ac; pc; nkc; pi for crt, cassette	$3,800	203
Data Products Corp., Systems Div. 6219 DeSoto Ave. Woodland Hills, Calif. 91364 (213) 887-8446	Porta-Com	30 lb. 18x19x5	impact	10	send - 128 char. receive - 64 char.	80	ac; pc; nkc (13 extra symbols); pi for card punch, crt, mag. tape, etc.	$2,450 $95/month	204
DataTerm, Inc. 1611 Manning Blvd. Levittown, Pa. 19057 (215) 949-1910	Model 35	38 lb. 20x18x8	impact	10,15	96 char.	132	ac; pc (opt.)	$1,800	205
Electronic Information Systems, Inc., 2400 Industrial Lane Broomfield, Colo. 80020 (303) 466-1985	ET-39A	25 lb. 18x13x7	impact	10	64 char. - upper case	72, 102 adjustable	ac (separate unit); pc (send only)	$1,359	206
Mite Corp. 446 Blake St. New Haven, Conn. 06515 (203) 387-2572	Model 123	29 lb. 19x13x7	impact	10,15 (opt.)	64 char.	80	ac; pc; pi (opt.)	$2,000	207
Novar Corp. 2370 Charleston Rd. Mountain View, Calif. 94040 (415) 964-3900	5-41	48 lb. (without case) 22x20x9	impact	15	standard Selectric	130	pc; pi; ac (opt.); nkc (opt.)	$4,050 $99/month	208
Texas Instruments, Inc. P.O. Box 66027 Houston, Texas 77006 (713) 526-1411	Data Terminal	32 - 38 lb. 19x19x7	thermal	10,15,30 40 (opt.)	94 char. or 86 char. PTT/BCD	80	ac (opt.); pc (opt.); pi	$2,565 $111/month	209
Tracor Data Systems, Inc. 6500 Tracor Lane Austin, Texas 78721 (512) 926-7770	1601	34 lb. 21x12x7	impact	10,15	64 char.	80	ac; pc; pi	$2,700	210
Vernitron Corp. 176 Central Ave. Farmingdale, N.Y. 11735 (516) 694-5002	Dataport VI	30 lb. 16x21x7	impact	10	96 char.	72 or 80	ac; pc (even)	$2,850 $93/month	211

The chart above gives the important statistics on some of the popular portable terminals now available. Note that the thermal printers are generally both lighter and faster than the impact printers, but they also tend to be more expensive and do not produce multiple copies of the output.

The crt terminal: swift, silent, mobile



The portable crt terminal has the capabilities of the page printer but does not produce printed output. Unlike a page printer the crt terminal contains a memory for retaining data displayed on a screen. This "refresh" or buffer memory provides a means to locally edit data prior to transmission and to divide the displayed data into specific fields for rapid entry. Because of this editing capability, less extensive software is required at the computer center. While large expensive cathode ray tube terminals have long offered these advantages, it is only within the past few months that they have become available in portable units such as that made by Applied Digital Data Systems.

Local editing can be performed through manipulation of the cursor, horizontal tab and screen erase controls. The user can choose various modes of operation. In the "conversational" mode there is no local editing and the typed character is simultaneously displayed on the screen and sent to the computer. In the "page" mode, the user can edit an entire page before transmitting it. A "message" mode helps edit page sections.

These portable crt terminals are able to display both fixed and variable data simultaneously. Fixed data can appear on the screen written in grey characters (half intensity) while the variable data is written in black. In this way, the computer can cause a blank form to appear on the screen which the user can then fill in. Fixed data cannot be lost since the cursor and erase controls operate only in the areas reserved for the variable data. Furthermore, only the variable data is transmitted, thus saving communication time.

Another feature which saves communication time on a crt terminal is its ability to scan ahead: if the rest of the line or the rest of the screen is blank, the cursor automatically resets itself. The "blanks" are not transmitted to the computer. Portable crt terminals are most useful in situations where:

- The formatting and editing capabilities are desirable.
- Reference to complicated formulae or other data is required to solve an immediate problem.
- Speed and flexibility are important, but hard copy is unnecessary.
- Communication line and computer time are at a premium.

One disadvantage of the portable crt terminal is that, if the user wants to use the crt to replace a teletypewriter, software modifications are required to compensate for the difference in the character length of the displayed line. The crt line contains 32 or 64 characters versus the teleprinter's 72 character line.

Manufacturer	Model	Weight	Dimensions	Characters per line	Lines per display	Data protect	Transmit variable data only	Insert and delete	Price and Lease	Information retrieval number
Applied Digital Data Systems, Inc. 89 Marcus Blvd. Hauppauge, N.Y. 11787 (516) 273-7799	Envoy 600	32 lbs.	22x16x7	32	16	no	no	no	$3,195 $151/month	212
	Envoy 640	32 lbs.	22x16x7	64	16	yes	yes	yes	$3,695 $174/month	213

Voice response: a word with your computer

The third class of portable terminals uses voice response for output. In general, these terminals are more suitable for applications where brief and simple replies to remote inquries are required and where computer interaction or hard copy output is not needed. While voice response terminals are relatively new, similar systems have been in existence for some time. For example, in credit verification systems a tone or a beep coming back verifies someone's credit standing. The simplest voice response system is one which responds to the tones of a Touch-Tone telephone. Here one has three options for terminals; a device for use with the ordinary dial-up telephone; a Touch-Tone telephone; or a terminal with a built-in keyboard and an acoustic coupler.

An example of a device utilizing a dial-up telephone is the Audio Response Terminal manufactured by Metro-Processing Corp. of America. Actually a coupler, this unit weighs under two pounds and is carried around in a small carrying case. It can be attached to the mouthpiece of an ordinary dial telephone in seconds. The user hears the response of the computer through the normal earpiece of the phone, and enters data through a small keyboard exactly like that of a standard Touch-Tone telephone.

While employing either a dial telephone with the acoustic device or a Touch-Tone telephone as input devices is very inexpensive, their very simplicity limits

their application. Training to use them must be more intensive than that needed for terminals with keyboards, and operator error rate tends to be high.

The portable terminal with its own keyboard is manufactured by such companies as IBM and Electronic Data Systems. These keyboards vary, containing as many as 60 keys. A significant feature is the identification card reader to prevent unauthorized use of the terminal or the computer. On some terminals, overlays can be placed on the keyboards to help the user perform different applications. The broader array of keys enables the user to generate much more information to the computer than does the use of an ordinary Touch-Tone pad. However, the data set used to receive the data at the computer is more expensive.

When should voice response terminals be chosen over other forms of portable terminals?

- When inquiries and responses are short and uncomplicated. Perhaps the maximum limit for inquiries or responses should be 10 words or codes.
- When a battery-operated portable terminal is mandatory due to lack of ac power.

Stock brokers operating outside their offices could use the voice response terminals for the latest quotation on a stock; a traveling salesman for the status of inventory; or a patrolling officer for the latest information on the status of a suspicious car.

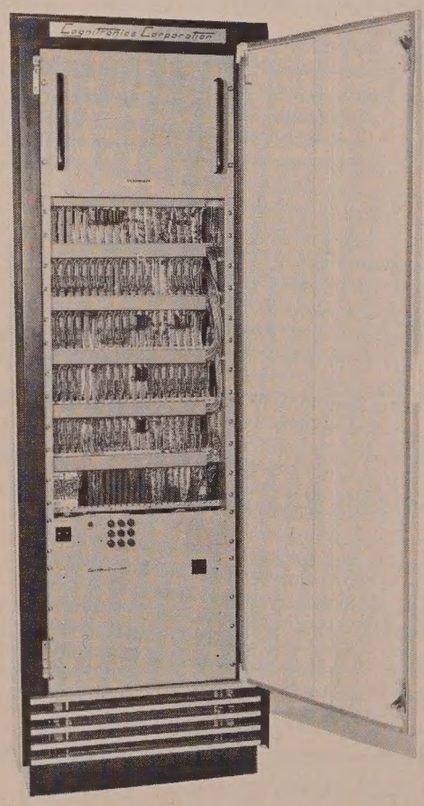
The words and phrases transmitted by a voice response terminal are produced in any of three ways: from magnetic drum (much like a tape recorder), from light modulated on film (like the sound track of a movie), and digitally through various filtering mechanisms. The light-on-film is relatively inexpensive and it is easy to change vocabularies, but the vocabularies are limited. The magnetic drum is reliable, and the digital method offers extended vocabulary with adequate computer disk storage. All have comparable response times.

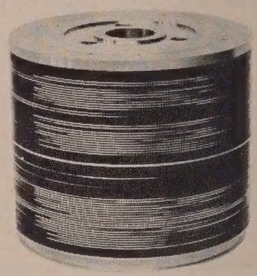
By the very nature of voice response systems, these terminals do not have any editing capabilities such as those of the crt terminals or software-assisted page printers. This fact of itself necessitates limited inquiries to the computer, for there is no way to correct an error in transmission. It has been estimated that the error rate is about one percent per digit.

Thus, it is necessary to protect the operator from errors as much as possible. The use of overlays that fit the keyboard help enormously, as do specially designed keyboards. Systems can also be arranged to read back to the operator the information which he entered. If he listens, he can catch his errors.

An attempt has been made to avoid the high error rate in the design of some portable terminals, where information is entered and stored on digital thumbwheel switches, and on slide switches. After all entries have been made, the data can be proofread for accuracy before it is transmitted to the computer.

A voice response system requires extensive hardware at the stationary computer headquarters. The voice response unit itself, which interfaces to the computer, can range in price from $10,000 to $150,000 depending on the vocabulary size required and the number of telephone lines to be serviced. The terminals are themselves are very inexpensive. When deciding whether to install voice response capability or not, a company with an existing teleprocessing system must consider the expense of mixing configurations by bringing in a voice response system which requires its own software and maintenance. In effect, a company would be paying for two systems by creating a voice response system along with an existing teleprocessing system.





Stationary hardware for voice response systems: A voice response unit (left) and an audio storage device such as a film drum (above) are necessary to analyze inquiries from portable voice response terminals and to produce the desired answer.

Regardless of which mode of interaction the user chooses, he will be adding significant capabilities to his existing computer systems. The near future will invariably bring a truly lightweight, battery powered portable crt terminal with hard copy option. □

Voice response keyboard terminals

Manufacturer	Model	Weight and Size	Power supply and modem at computer	Number of keys	Provide fixed identification code?	Price and Lease	Information retrieval number
Chancellor Industries, Inc. 2416 LTV Tower Dallas, Texas 75201 (214) 741-7283	PRT	5 lb. 9x9x3	ac or battery 401 or 403	16 60 key alphanumeric option	yes, card reader option	$500 (approx.)	214
Computer Utilities N.W. 900 Thomas St. Seattle, Wash. 98109 (206) MU 2-6836	Accutone 100	8 lb. 9x12x3	ac, battery option 403	12	yes, via card reader	$875 $25	215
Computone Systems, Inc. 361 E. Paces Ferry Rd. N.E. Atlanta, Ga. 30305 (404) 261-0070	CT-60	9 lb. 12x18x4	ac or battery 403	60 switches, numeric only	yes, via internal card	$700	216
Computone Systems, Inc. Martinsville Rd. Liberty Corner, N.J. 07938 (201) 647-3200	CT-14	9 lb. 6x13x13	ac, battery option 401 or 403	input via switches 12	yes, card reader optional	$500 $20	217
IBM, Data Processing Div. 112 E. Post Rd. White Plains, N.Y. 10601 (914) 949-1900	2721	10 lb. 16x9x4	ac or battery 401	60	yes, optional	$600 (numeric only) $20	218
Technitrend, Inc. 7300 N. Crescent Blvd. Pennsauken, N.J. 08110 (609) 665-4910	TT 3100	7½ lb. 12x12x6	ac or battery 403	12	yes, card reader optional	$350	219
Vernitron Corp. 176 Central Ave. Farmingdale, N.Y. 11735 (516) 694-5002	VTT-3	15 lb. 18x14x4	ac or battery 401	61	yes internal mag. tape cassette option	$500	220

Stationary voice response hardware

Manufacturer	Computer system used	No. of words and No. of phone lines	Price	Information retrieval number
Burroughs Corp. 6071 Second Ave. Detroit, Mich. 48232 (313) 875-2260	B300, B342, B500 to B6500	189 up to 125	$37,500	221
Cognitronics Corp. 333 Bedford Rd. Mt. Kisco, N.Y. 10549 (914) 666-2941	Interface with most popular systems	10 to 189 2 to 200	$1,039 to $14,000	222
Data Trol, Inc. Kane Industrial Dr. Hudson, Mass. 07749 (617) 562-3422	IBM 1800, IBM 1130	31 to 189 1 to 60	$80,000 (16 lines, 189 words)	223
Honeywell, Inc. Fourth Ave. S. Minneapolis, Minn. 55408 (612) 332-5200	Honeywell series 200	31 to 189 1 to 60	$40,600 to $260,000	224
IBM, Data Processing Div. 112 E. Post Rd. White Plains, N.Y. 10601 (914) 949-1900	System/360 30 to 75	32 to 128 10 to 50	$55,870	225
	System/360 30 to 75	unlimited words 2 to 8	$29,100	226
RCA Corp., Info. Systems Div. Rt. 38, Haddonfield Rd. Cherry Hill, N.J. 08034 (609) 963-8000	Spectra 70 series	31 to 189 10 to 50	$24,250 to $38,800	227
Technitrend, Inc. 7300 N. Crescent Blvd. Pennsauken, N.J. 08110 (609) 665-4910	IBM 360/30 and up	32 to 700 2 to 256	$36,000 and up	228

Choosing the medium for your message:
The three different modes of output employed by portable terminals — printed page, crt display and voice response — are each suited for different applications. The following chart lists some user needs and classifies the output style according to how well it satisfies these needs.

User needs:	Page printer	Crt display	Voice response
Battery operation	3	3	1
Local editing	2	1	3
Silent operation	2	1	2
Hard copy	1	3	3
Lightweight	2	2	1
Input format control	2	1	1
Output format control	2	1	2
Rapid data transmission	1	1	2
High volume input/output	1	1	3
Application versatility	2	1	3
Hardware reliability	2	2	1

1 – Most suitable 2 – Acceptable 3 – Least suitable

GENERAL ELECTRIC'S

TermiNet

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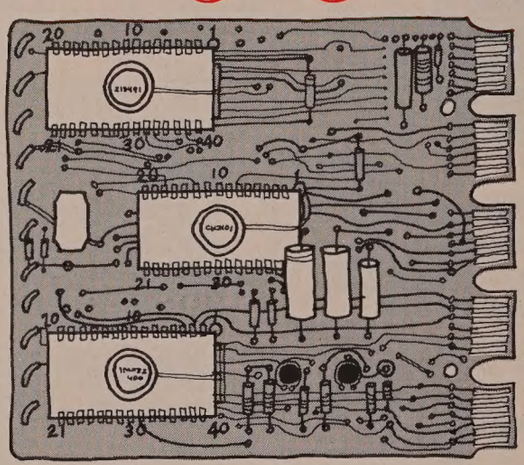
10, 15, or 30 characters per second...more than twice the speed of conventional equipment, so you get the most from today's high-speed data generation and communication equipment. This can mean big savings — in your office, in computer time and in the use of communication lines. This extra quiet impact printer makes less noise than an office typewriter, so it can be where it is needed... where your people are.

...Highly Reliable



The TermiNet 300 printer is basically an electronic device with a minimum of mechanical parts. There is no moving carriage and the electronic keyboard has a light touch for rapid, accurate typing. You also get high reliability and compactness by the use of large-scale integrated circuitry.

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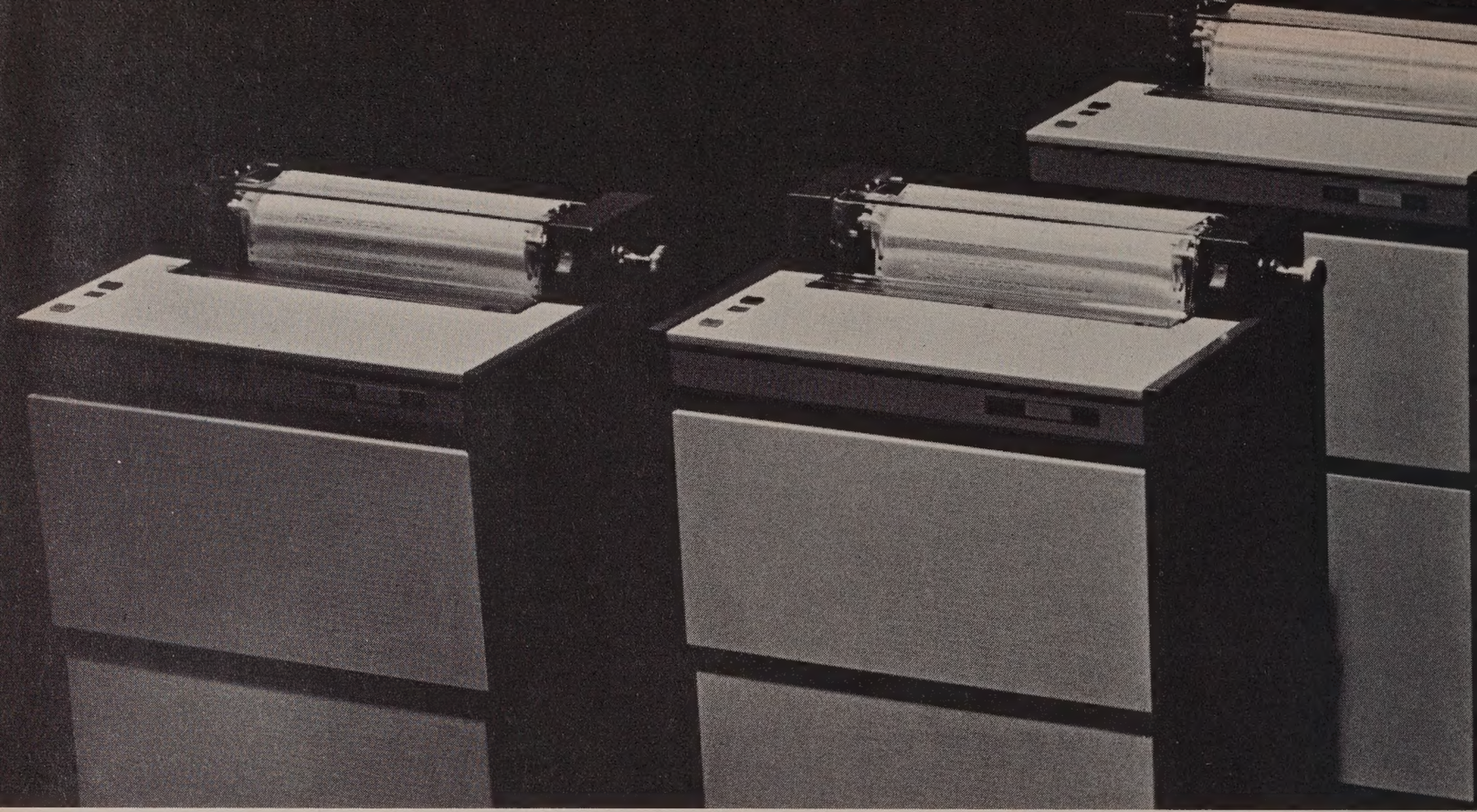

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We throw in peace and quiet.

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At 250 characters a second, Videojet is whisper-quiet. That's because it prints a completely new way—with an ink jet.

As a remote line printer, Videojet prints as fast as your telephone lines can deliver the data. And it's plug to plug interchangeable with IBM 2848/2260 terminals.

Videojet can receive data from any digital source, so you can use it as an on-line printer for mini-computers and other applications. It prints the full 136 column lines on standard fan-folded business forms. And the adjustable print density feature lets you print up to 200 columns on 14⅞" paper or up to 120 columns on 8½" paper.

Because Videojet is electronic, there aren't a lot of mechanical parts to break down. And unlike other jet printers, a single jet does all the printing.

Videojet. Another product to make information more manageable from A. B. Dick Company, 5700 Touhy Avenue, Chicago, Illinois 60648.

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INFORMATION RETRIEVAL NUMBER 8

Be mean about management reporting

by Dr. Norbert L. Enrick
Kent State University
Kent, Ohio

So thunderous has been the outpouring of data in many management information systems, that staff and executives alike often feel engulfed. The choice between wading through miles of computer print-out for the needed information, or simply ignoring the available data, is not a happy one. However, relief may be found by using a system that provides reports mainly on an exception basis, that is to say, when some variable, such as overhead costs, falls outside certain set limits. One method of determining when to issue exception reports is control chart methodology. It affords an efficient and rational application of the exception principle of management.

Setting limits for quality control

Control chart analysis originated in production and engineering management as an aid in quality control. Because of some variability in materials, processes, measuring techniques and ambient conditions, proper control of quality distinguishes between chance, and, therefore allowable, variations in dimensional, strength, or other characteristics of the product and significant or assignable causes of variation. The pertinent distinguishing criterion is the control limit. When actual test results, plotted on a time-chart, fail to stay within allowable limits, the probable presence of trouble in the processing equipment, the material being fed or the method of operation is signaled. Corrective action is thus called for. But a certain risk of error remains. For example, limits set at a 95 percent confidence level incur a five percent risk of signaling trouble when actually none exists. Management decides on the level of risk to establish. The risk could be reduced to one percent, for example, but this involves more testing and consequently higher costs.

The control limits are based on the statistical idea that measured variables are usually distributed about a mean in some regular fashion, often referred to as a normal distribution. The possibility that one measured value will fall at the extremities of the normal distribution can be easily estimated from standard formulas and charts. However, no complex math is required to make use of the formulas and charts. A few examples will show how the approach works.

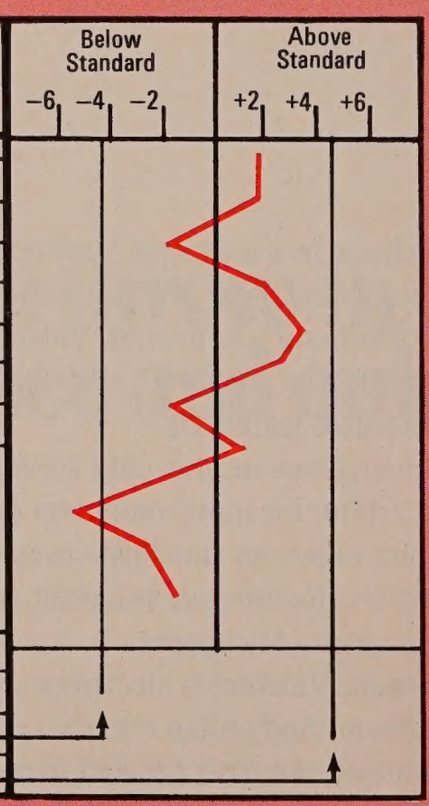
Controlling variable costs

As an example of control chart procedures, let's consider a manufacturing company with both fixed and variable overheads. Variable overhead (Table 1) can be measured as a percent of direct labor cost. In 1967 the standard was ten percent, but in 1968 and 1969 it was increased, first to twelve and then to fifteen percent, to reflect reduced direct labor as a result of automation. The steps in forming the control charts are:

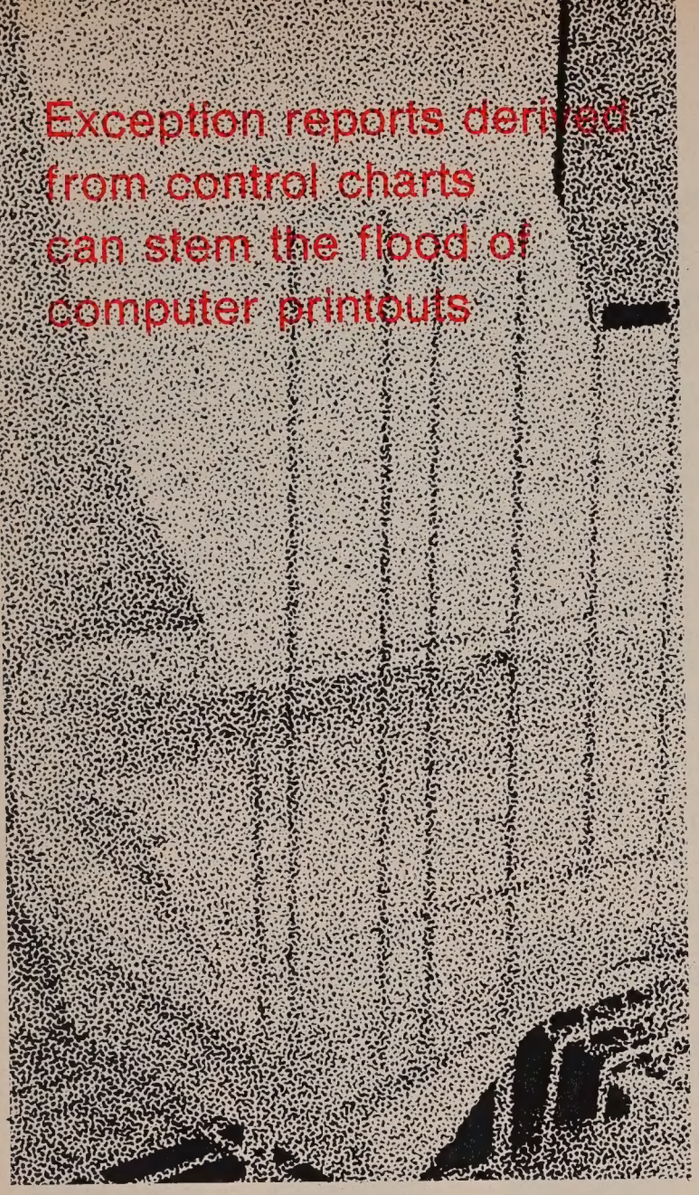
Establish typical patterns of variability from past data. The first two years are used for this purpose. Since

Table 1: Variable overhead

Year + Quarter	Standard	Actual	Deviation from Standard	Range
'67 I	10	12	+2	
II		12	+2	0
III		8	−2	4
IV		12	+2	4
'68 I	12	14	+4	2
II		15	+3	1
III		10	−2	5
IV		12	0	2
'69 I	15	10	−5	
II		12	−3	
III		13	−2	
IV				
Total of ranges				= 18
Average range = 18/7				= 2.6
Lower control limit = −2.6 x 1.8 = −4.7				
Upper control limit = 2.6 x 1.8 = 4.7				



The first eight quarters establish the typical patterns from which the control limits are calculated. The first quarter of 1969 shows an out-of-control condition. The figure used in calculating the limits comes from Table 2.



the standards varied from 1967 to 1968, the deviations of actual results from standard are used for control. Thus in the third quarter of 1967, the actual cost of eight percent deviates by two percentage points from the standard percentage variable cost of 10 percent.

Establish the past pattern of variability, as reflected by the successive ranges. For example, for the first and second quarters of 1967, the deviations from standard were two percent. The range, representing the difference between these two values, is zero. Next, between the second and the third quarters of 1967, the difference is $2 - (-2) = 4$. Ranges are always shown as absolute, hence positive differences. From all seven individual ranges an average of 2.6 is obtained.

Using a set of limit factors, calculate the control limits. The control limit factors are obtained from a standard table based on a normal (Gaussian) law of errors and a 95 percent confidence level. From Table 2, the control limits are:

limits = goal value ± (average range) x F_i

limits = 0 ± (2.6 x 1.8) = 4.7 and −4.7

The goal value is zero because we wish to deviate by zero from the standard ratio for variable overhead as a percent of direct labor.

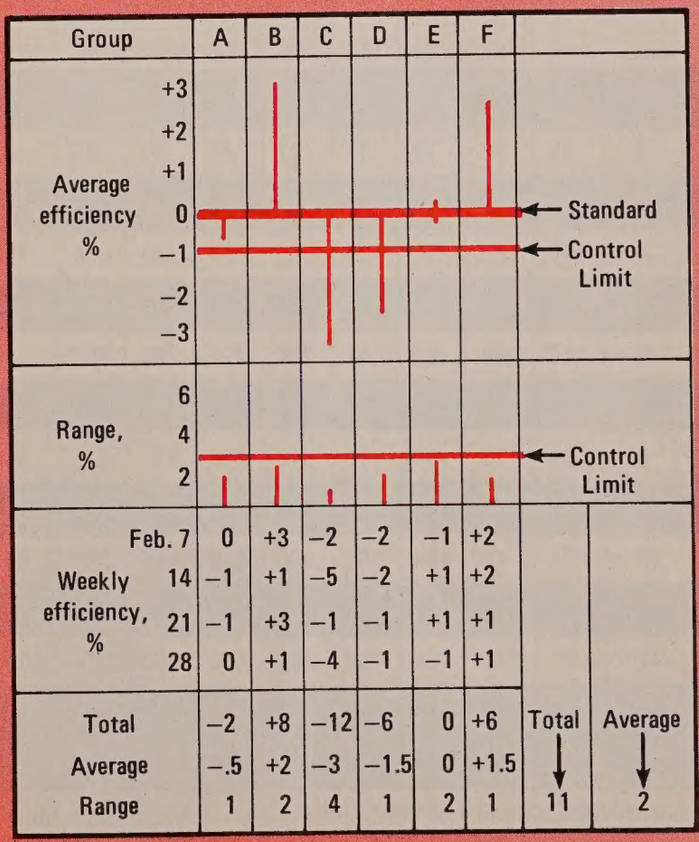
In this control chart, an out-of-control point occured in the first quarter of 1969. A shortage had developed of skilled technicians for the purpose of product inspection and machine maintenance. As a result, management was not attaining requisite quality and reliability of output. At the same time inadequate maintenance frequencies threatened an adverse effect on the life of equipment. Deficiencies in the firm's training and recruiting program were noted as prime causes for the shortages. With correction of out-dated procedures and policies, costs moved gradually back into standard.

Table 2: Control limit factors

Values for each range	Control limit factors for the plotting of: Individual values	Successive average	Range of variation
	Factors F_i	Factors F_a	Factors F_v
2	1.8	1.25	2.51
3	1.3	0.68	2.05
4	1.0	0.49	1.75
5	0.7	0.37	1.74
6	0.6	0.32	1.67
8	0.5	0.25	1.57
10	0.4	0.20	1.52

These factors will result in a 95 percent confidence level based on a normal (bell-shaped) distribution of variables. This table is adopted from the American Society for Testing and Materials, Manual on Quality Control of Materials, (Philadelphia, 1951, page 115).

Table 3: Machine efficiency



Although both machines C and D are below the control limit for average efficiency, machine C is also showing a variability outside the acceptable range. This double indication may help to pinpoint the cause of machine C's poor performance.

Data parsimony . . .
(continued)

This example highlights the need for concern not just with high but with unduly low costs. In this instance, they signified hidden losses. At other times they may point to faulty recording of source information or improper data processing.

Keeping machines in line

In some cases control limits may be set up for more than one factor. For example, in a machine shop, the management may be interested in both the efficiency of each machine and the range of operating performance. Let's assemble a group of five machines.

For each machine (Table 3 on page 29) the efficiency values are expressed as deviations from standard output. The range of efficiency for each of four values is the difference between highest and lowest efficiency. Machine *B*, for example, has a range of 3 - 1 = 2. The average range of all groups is 2. From the table of limit factors the lower control limit for average 4-weekly efficiency is:

control limit = goal − (average range) x F_a
= 0 - (2 x 0.49) = 1.0

The upper control limit is obviously of no concern. However, the control limit for the range of variability is:

control limit = (average range) x F_v
=2 x 1.75 = 3.0.

In table 3 (page 29) only *C* has exceeded the range limits. Undoubtedly, the low average efficiency is at least in part caused by the high variability in performance. This provides a plausible clue for corrective action: check into the variability in group *C*.

Pointing out production needs

Production control is an almost-perfect situation for control chart techniques. Consider a firm that required heavy inventory build-ups during the off-season so as to be able to supply demand during peak season. Because of poor forecasting techniques, the sales department keeps on changing the anticipated volume, thus causing high costs and inefficiencies for changes in setups, dies, fixturing, assembly-lines, and finishing formulas in the various production departments. A system was worked out whereby the past four years' sales experience, as a percent of total sales, would serve as the typical pattern of sales build-up for a season. Next, past variability was used to establish control limits. It was agreed that no changes in inventory build-up or production schedules would be made unless the current trend of sales went outside the upper or lower control limits. After some trials and adjustments, the system eventually worked to the satisfaction of all concerned. The control chart took the form of a cumulative, typical sales build-up pattern with the control limits (see chart). Actual sales, when they exceeded the upper limit, signaled the need for increased production. Charts were maintained for 50 product styles, but only the out-of-control conditions were reported.

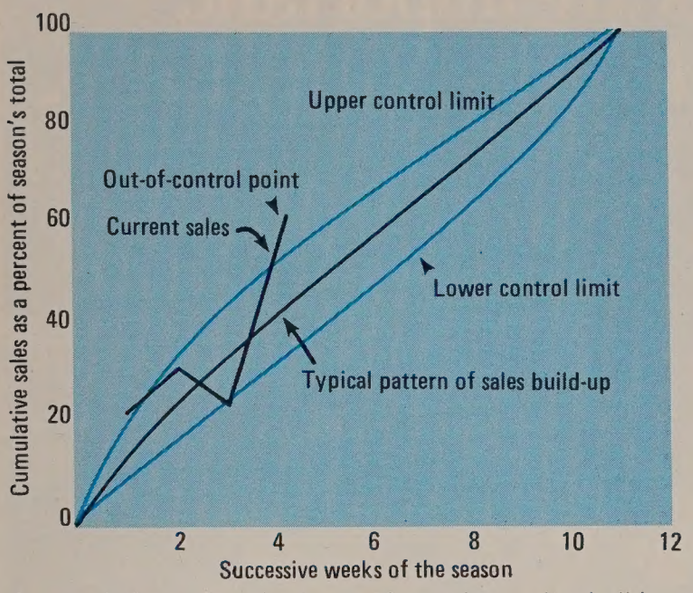
To set up the chart, the weekly sales for four years is tabulated (see Table 4). This past experience is then converted to percentages of total sales, thus making the years comparable. From the total and average cumulative sales, the typical weekly pattern of sales

Table 4: Sales data

	Weekly sales				Cumulative sales				Cumulative sales as a percent of the season's total sales								
														Average		Control limits	
Week	'66	'67	'68	'69	'66	'67	'68	'69	'66	'67	'68	'69	Total	(rounded)	Range	Upper	Lower
1	11	18	29	8	11	18	29	8	2	3	3	1	9	2	2	4	0
2	16	30	29	17	27	48	58	25	5	8	6	3	22	6	4	10	2
3	16	42	28	35	43	90	86	60	8	15	9	7	39	10	6	16	4
4	33	66	29	24	76	156	115	84	14	26	12	10	62	15	7	22	8
5	32	48	77	50	108	204	192	134	20	34	20	16	90	22	10	32	12
6	76	48	96	67	184	252	288	201	34	42	30	24	130	32	12	44	20
7	75	84	134	101	259	336	422	302	48	56	44	36	184	46	16	62	30
8	87	72	154	118	346	408	576	420	64	68	60	50	242	60	14	74	46
9	86	72	134	168	432	480	710	588	80	80	74	70	304	76	10	86	66
10	32	48	154	151	464	528	864	739	86	88	90	88	352	88	8	96	80
11	54	60	57	51	518	588	921	790	96	98	96	94	384	96	4	100	92
12	22	12	39	50	540	600	960	840	100	100	100	100	400	100	2	102	98
Total	540	600	960	840													
Average	45	50	80	70													

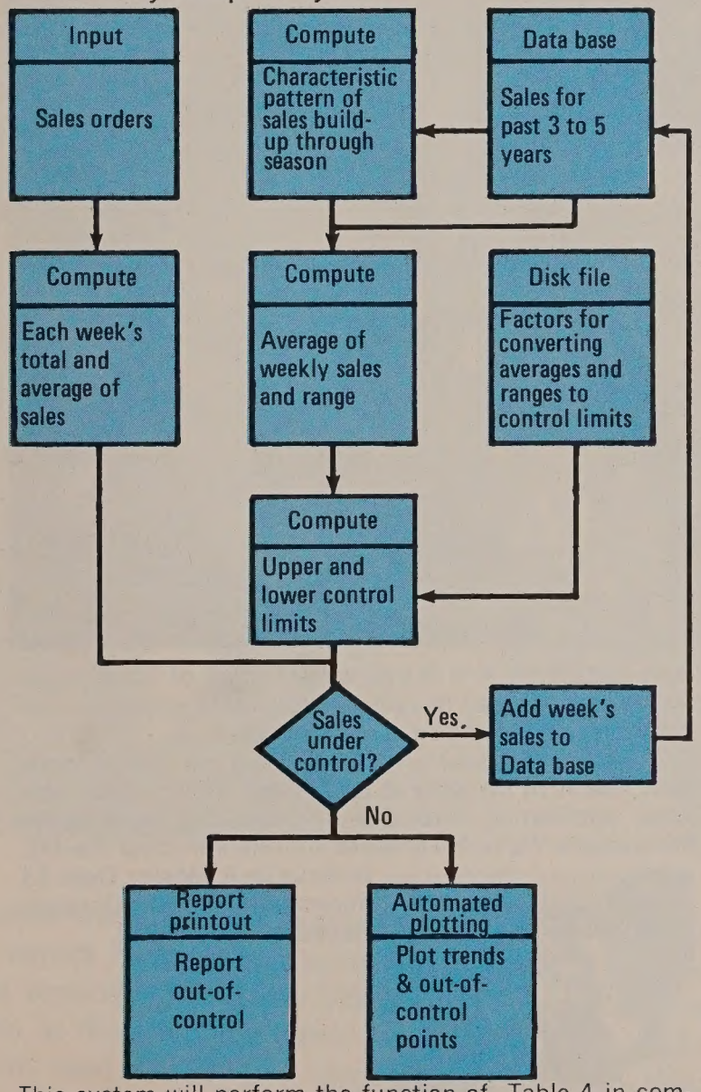
Control limits need not be fixed, as this table shows for a weekly sales build-up over a season. Here the range of the limits is low at either end of the period, indicating a need to keep a close watch on the sales figures.

Cumulative sales chart



A cumulative sales chart can show when sales build up sufficiently to require an increase in manufacture or fall enough to warrant a cutback. Detailed reports are only issued when the sales exceed a limit.

A control-by-exception system



This system will perform the function of Table 4 in comparing the actual sales with the characteristic pattern derived from the previous four years' sales. When an out-of-control situation occurs, the system will print out a suitable report and, if required, a trend chart.

build-up is obtained. Next, the range based on the highest and lowest cumulative sales value per week indicates past patterns of variability (which are expected also to prevail in the coming year). With four values per range, the control limit factor F_i is 0.1. The goal value for control charting is the past typical pattern average. The formula thus becomes:

control limits = average $\pm$ range x F_i.

For week 1:

control limits = 2 = (2 x 1.0) = 4 and 0.

For the second week, the limits are:

6 $\pm$ (4 x 1.0) = 10 and 2.

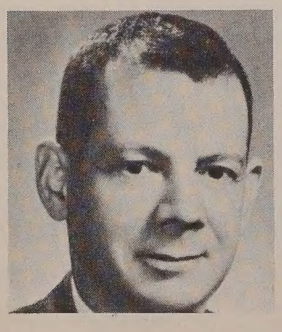
The use of past averages does not affect the adoption of a higher absolute goal for this year as against last year. For example, 50 units may have been 20 percent of the total in a given week of last year (with 250 as the total). But 80 units may be 20 percent of a total of 400 predicted for the coming season. The absolute sales volume is forecast from past trend projections and other methods involving quantitative evaluation and qualitative judgement of the market.

Implementing exception reporting

Exception reporting can be readily translated into computer programs (see chart). In the previous production-sales coordination application the following major steps are involved:

- From existing data banks (sometimes modifications and enlargements may be needed), records of sales and sales orders will be on hand for the past several years. It is then a simple matter to compute the subsequent cumulative sales representing the characteristic sales build-up pattern for the coming season. Averages and ranges are similarly computed by simple routines.
- The conversion factors to obtain the control limits from averages and measures of variability, are stored in the computer (using conversion factors, Table 1).
- Provision is next made to enter current bookings of sales and sales orders. Comparison of actual sales against typical patterns and control limits then leads to identification of *in control* or *out-of-control* conditions.
- When an off-standard condition occurs, it may be reported to management as either a simple print-out with details of the nature of the problem or as both a print-out and an automatically prepared control chart.

The system is applicable to all major products or product groups, depending on the degree of detail of control that is to be accomplished. While preferences and emphasis on philosophy and procedures of control will vary, the systems flow chart provides a basic framework from which modifications can be developed as desired. □



Until recently, Dr. Norbert Enrick was a full-time consultant concerned with applications of management-science systems. Currently, he is professor of management at Kent State University. The material in this article is slated to be included, later in the year, in his next book, **Decision-Oriented Statistics,** (Brandon/Systems Press).

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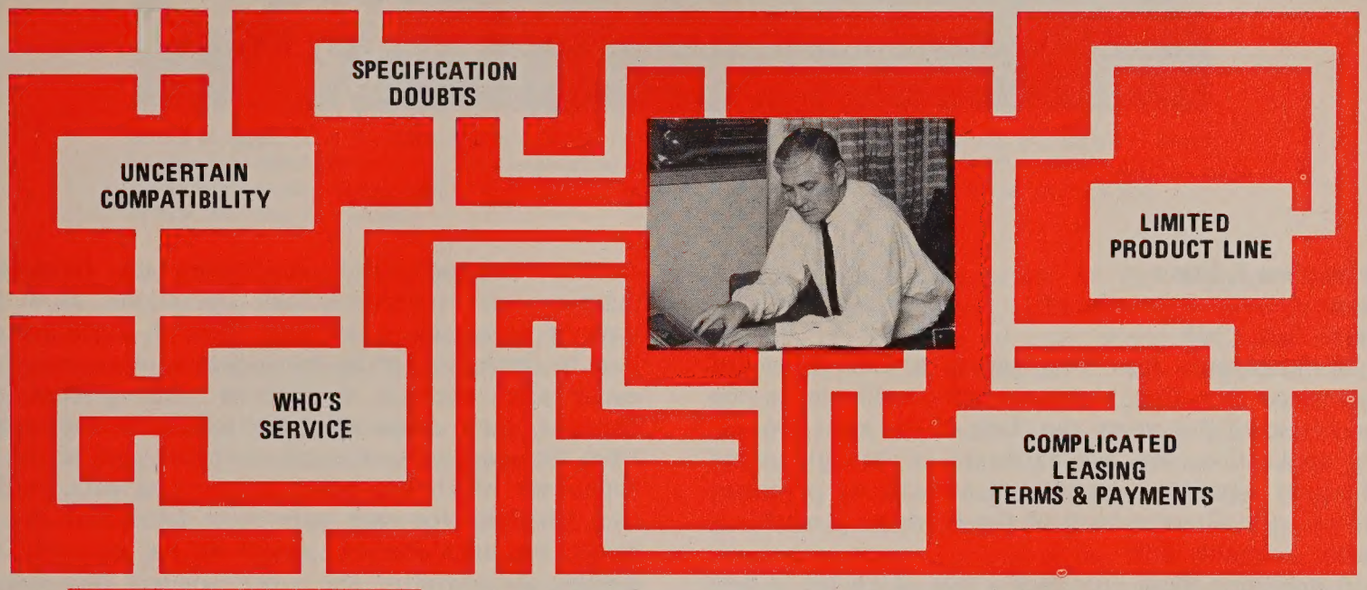

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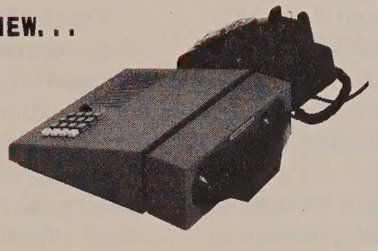
NEW. . .



VERNITRON VOICE

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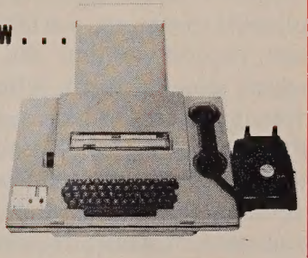

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INFORMATION RETRIEVAL NUMBER 9

Minicomputers speed automation on the factory floor

The ubiquitous mini has found its way to the assembly line where it is being used extensively for the efficient control of fabricating machinery.

by Stephen J. Fryer
General Automation, Inc.
Santa Ana, Calif.

Minicomputers have been put to a wide variety of uses since they first became readily available on the market some five years ago. One of the most promising applications for this hardware is the automating of highly repetitive, complex manufacturing processes through the direct control of the fabricating machines on the assembly line.

Automating these processes is not, of course, a new development—automated fabricating machines using hard-wired logic to control their movements have been around for quite some time. However, minicomputer control can offer users significant advantages over hard-wired logic. The first and foremost of these advantages is flexibility. For example, after loading the applicable program, variables can be changed by keyboard request so that the mini-controlled fabricating machine can perform different jobs or accommodate different patterns (such as drilling a different sized hole within the same job classification, or winding a coil with a smaller- or larger-gauge wire).

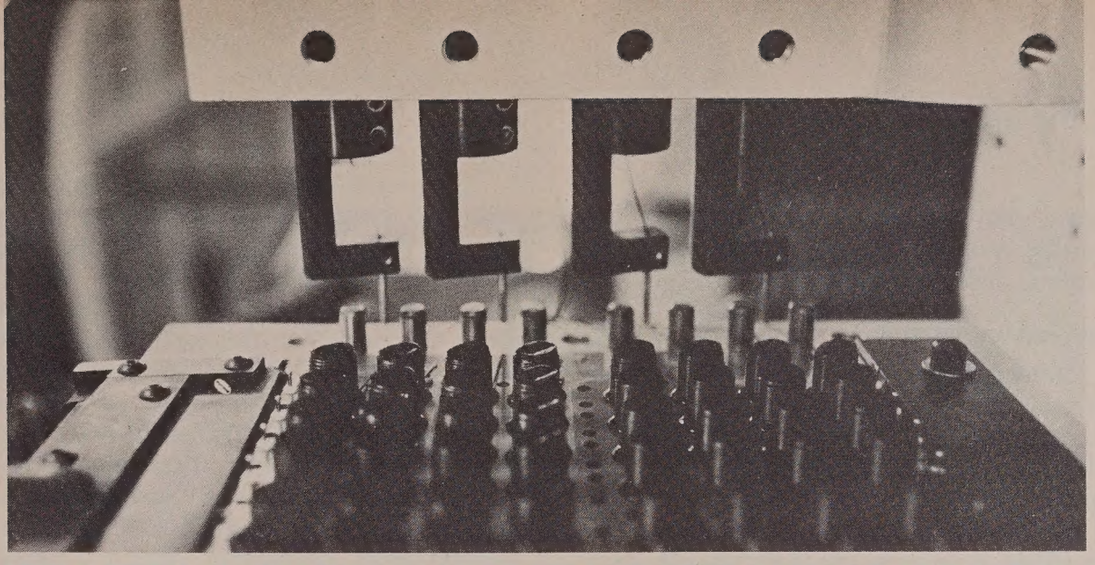
If hard-wired controllers were used, each change in job or pattern would require a corresponding change in the hard-wired logic—a time consuming and expensive process. Minicomputers are also capable of controlling more than one machine. Generally, one hard-wired controller is required for each fabricating machine. Using small minicomputers, however, we have installed systems where up to 16 different machines are being controlled by one computer. The minicomputer gives repetitive accuracy and can take corrective action when an out-of-tolerance situation arises. Finally, the minicomputer offers decreased maintenance costs compared with a conventional hard-wired controller, especially when the controller uses significant numbers of electromechanical relays.

Putting the mini to work

The coming configuration for minicomputers and fabricating machines on the factory floor is the so-called "distributed computer concept." In this configuration, each minicomputer is linked to a larger, supervisory computer within the factory area. This larger computer provides storage and back-up for the smaller "worker" minis controlling the fabricating machines and supervises their operations. How this type of automatic supervisory control functions can best be demonstrated by the sequence of events which occur when there is a machine failure. When this happens, data concerning the failure is transmitted from the machine to the minicomputer and on to the supervisor which has been programmed with production schedules for each part being fabricated. At the same time an alarm will sound on the assembly line alerting the operator. The supervisor will then consult its pre-programmed schedules, and notify another mini down the line that it may have to do more work. This second mini will then notify its operator so that whatever mechanical changes are required (for example inserting a larger coil of wire in the fabricating machine) can be carried out.

On the factory floor, then, minis serve two functions: they control the operations of the fabricating machines themselves, and they provide and receive information on machine status for the benefit of the human operators. These control and information functions are grouped into a hierarchy that can be looked at as the analog of a typical corporate hierarchy: At the lowest level (the assembly line) control is on the same basis—the human operators are concerned with only one (or possibly two) machines. At the supervisory computer level, where management of many computers is being carried out, control involves several minicomputers (and several machines). The information provided by the supervisory computer concerns more general items such as schedules and analysis of machine breakdowns and production rates.

While the distributed computer concept is the most common configuration, it is by no means the only one. Some applications (such as component insertion on a printed-circuit-board assembly line) may require only a "stand alone" worker minicomputer. This type of setup may be sufficient if the mini is required only to control the fabricating machine. If, however, both control and information are required, a larger stand-alone mini may be set up in a "worker-supervisor" configuration. In this case, the one machine would provide both functions—controlling the fabricating machine and providing management with information. Growth into a fully distributed system can occur later if needed.



Minis at work: At a Western Electric plant, minicomputers control the activities of machines used in the manufacture of coils for touch-tone dialing switches. The eight-by-eight matrix plate containing plastic shells upon which the coils are wound is shown below; above, four of the actual winding machines.

Controlling production at Western Electric

Minicomputers are particularly suited for controlling the manufacturing of small, complex components such as electronic parts where tight tolerances are commonplace. For example, Western Electric uses them to control the large-scale production of switches used in touchtone dialing.

A critical component in the switch is the coil, consisting of two primary and secondary windings. These windings are made on plastic shells—about two inches long—which extend on both sides of an eight-by-eight matrix plate, as shown above. The computer's job is to control the actions of three pulse motors. Two drive the x and y axes of the table on the winding machine so that the proper matrix is positioned under the winding head. The third motor controls the z axis as the actual windings are made on the coil. An encoder on this motor reads 512 pulses for every complete wind of the coil. The wire itself is 0.020 inches in diameter.

The problem of controlling this machine, is of course, a problem in responding to the 512 pulses and raising the table 0.020 inches so that the next wind can be made. Additionally, the coil must be wound in a continuous helix to avoid overlapping. In the case of the hard-wired machinery formerly used by WE, the response rate was limited to about 1/1000 of a minute (60 milliseconds), with the result that the z-axis motor jumped 0.020 inches each 512 pulses. Because the z-axis moved abruptly, about 10 percent of the coils were rejected for overlapping windings. To cut down this rejection rate, WE installed 4k computers to act as controllers, replacing the hard-wired logic. These computers were able to respond 20,000 times per minute or once every three milliseconds, 20 times faster than the hard-wired logic. This allowed the computer to take advantage of 0.001-inch movement per pulse of the z-axis motor. In operation, the computers averaged the pulses out so that output to the z-axis motor occurred every 25.6 pulses and each winding step was made in increments of 0.001 inches (20 times per revolution) instead of 0.020 inches. The substitution of minicomputers for the hard-wired logic formerly used effectively brought the 10-percent rejection rate down to zero.

The actual configuration at the Western Electric plant consists of some eight winding machines, each capable of handling 16 coils (eight per side of the matrix plate). The minis used for this purpose are SPC-12's, each with a Teletype for operator intervention and print-out. The supervisor computer is also an SPC-12 with a disk attached. This supervisor oversees the operation of each of the winding machines by using data on the day's production schedule. If one of the winding machines (or one of the 16 coil winders) fails because of a jammed wire or a similar problem, the supervisor takes it off-line, notifies the operator on the assembly line as to what the problem is, and increases production on another one of the machines. In addition to handling the chores of supervising the coil winders, this computer also controls a series of minicomputer-controlled wire-wrapping machines.

Programming the system

The actual programming of this system took place in several stages. The first stage was the writing of the overall systems specifications. These specifications included the definition of the finished product thus providing the criteria around which the system had to be developed and implemented. Additional information was then obtained on the design specifications of the machines. This covered such things as the start-up and overrun characteristics of the motors (how long it takes to get one running at full speed; how long it takes to stop). Other constants also defined the table upon which the fixture would be mounted. This mass was expressed in terms of how many milliseconds it would take to stop the table when the z-axis motor stopped. Top and bottom limits were initially established for this constant; later, when the system was up, the constants were tuned to reflect actual operating conditions. About 50 such variables defining the actual production machinery were set up. Error routines were also created, consisting mainly of exceptions when excessive table motion occurred. For example, an error occurred if the x and y axes moved more than 18 inches, or if the z axis moved more than 1.125 inches. WE required eight different applications programs each capable of winding coils according to eight different patterns. We had to set up the selectable operating requirements at this point involving such things as the

number of winds, the primary to secondary winding ratios, etc. Variables were also set up to allow operator selection of patterns and winding machines.

Minis speed aircraft production

The use of minicomputers in assembly-line applications is not, of course, limited solely to the production of electronic components. Grumman Aircraft, Bethpage, Long Island, New York, is using them to control the close-tolerance riveting of aircraft wing panels. In this case the rivets used are made of titanium, and require a controlled time/pressure function in their application. Using exotic metals such as this requires a great deal of care—a rivet that is formed too rapidly can easily become brittle.

Before minicomputers were used, machine riveting was accomplished by regulating the motion rate of anvils and the formed dimension of each individual rivet. This type of control was adequate as long as the rivets were the same—that is, the same type, shape and size, and were used to join the same thicknesses of materials. Usually, however, these parameters change constantly, resulting in the need for logic—either human or electronic controllers. To get around this problem the company devised a new concept in machine riveting using a minicomputer, which enabled them to regulate the anvils' force rates—rather than the movements rates—and the formed dimensions of the rivets.

The riveting system itself consists of a 16-by-16 foot center section where the riveting is actually done. Projecting from each side of this section are 45-foot-long workpiece carriage beds. The location to be riveted is positioned in the center section where it is drilled, deburred and coated with a sealant. A proper rivet is then selected and dropped into the hole. When the rivet is in the proper position, the anvils close and flare it. The heart of this system is a 12k minicomputer, which commands and controls all these functions. In operation, it handles the preliminary steps of positioning the workpiece (the wing panels) in the proper *x-y* positions for each of the assembly and fabrication procedures, and positions the anvils so that their centerlines are normal for the piece being worked on.

In initial assembly operations, seven different types of rivets are used. The control system must first note the different forces required to flare each rivet, and must know the various forces to be applied to different rivet head styles—even though they may have the same body diameter. A further complicating factor in the process is the fact that the force/time curve for any given rivet style and size is not linear—the control system must vary the anvil force as a function of time measured in milliseconds. Located on the actual riveting machine are position transducers and end-of-operation indicators. These feed signals through an interface to the computer's input/output section. Another interface unit enables the minicomputer to output driver signals for the workpiece carriage and functional actuators. A Teletype is used to signal start and stop operations; the Teletype's paper-tape reader is used to load the mini-computer programs.

Things get moving when the minicomputer—loaded with the proper program receives a Teletype signal to start the operation. First off, the program maneuvers the workpiece into proper position and then causes probes to determine if the centerline of the work is normal to the workpiece surface. Next, the working tools — drills, deburrer, sealant applicator, rivet loader and anvils—are correctly adjusted and given the signal to go. When forming a rivet, the computer monitors its clock in relationship to the force cell outputs from the anvils, making any necessary adjustments to keep the force/time curve within prescribed limits. At the same time, if a signal shows up on a workpiece load cell, the anvils are moved as a unit so as not to disturb the squeezing force between them.

In this system, the operator can get a printout of pertinent data as operations progress by simply keying an appropriate code on the Teletype. Such information includes rivet position, force/time relationship, work centerline adjustments and finished rivet length. The operator can select certain portions of the complete fabrication for analysis or he can call for data on the whole assembly. In using a minicomputer in the riveting process, certain advantages became quite apparent. In the first place, the cost was far less than the equivalent hard-wired circuits. Furthermore, the minicomputer controller system has almost unlimited flexibility —inexpensive software changes can accommodate almost any changes in the performance of a machine.

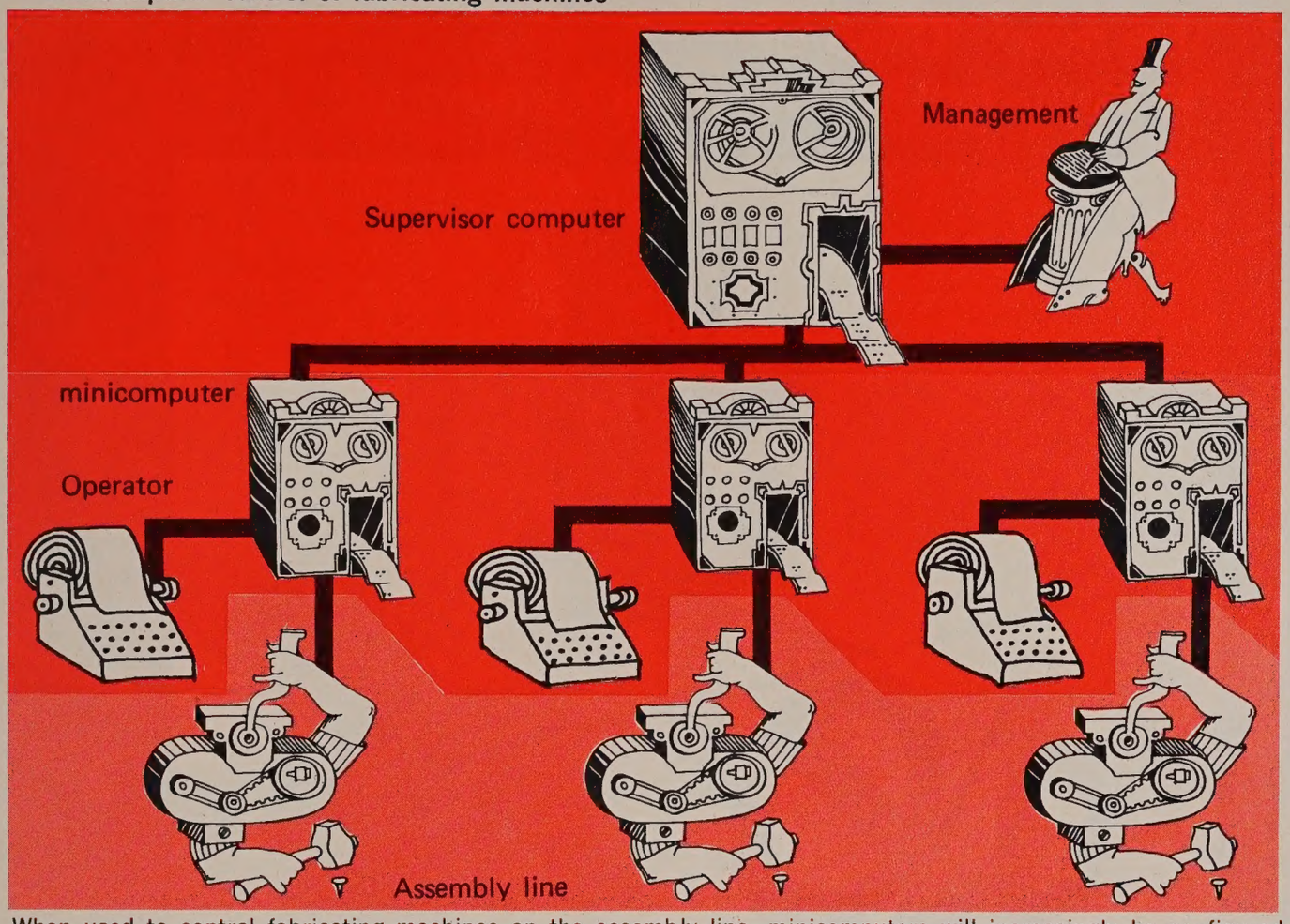
What does it all cost?

These two applications serve to illustrate how minicomputers can be put to work in repetitive assembly procedures marked principally by a need for automation, and by high speed and a high degree of accuracy. Putting minicomputers to work in these areas, of course, requires a careful study of the individual application. Costs will also vary per application, but an idea of what they are may be gained by a study of the installation at Western Electric.

The work was done by us on a fixed-fee basis and was broken down into four steps: First, there was what might be called a "definition stage" in which we went in and defined WE's coil-winding system as it was, and made a determination of whether automation by computer was feasible. This involved determining speed requirements, available equipment and tolerance specifications on the finished product. Work in this phase including writing the outline specifications, estimating the costs and projecting the programming effort involved. Time here was between two and three man-weeks at $1,000 per man week.

The second stage of our installation involved the creation of detailed specifications of the project. Work here was basically defining how we were going to automate the winding process with minicomputers, creating a detailed systems analysis study and pinpointing the price of the system. Time expended in this phase was approximately two man-weeks. Once we had these definitions in hand, we were able to proceed with the actual construction of the system. The first step was a detailed flowcharting of the assembly logic and programming.

Minicomputer control of fabricating machines



When used to control fabricating machines on the assembly line, minicomputers will increasingly be configured in the "distributed computer concept," as shown above. In this configuration, each "worker" minicomputer on the assembly line is interfaced to a fabricating machine, providing control of the machine's movement, and information on its operating status for the machine's operator. This information is sent to the supervisor computer which also controls the activities of the "worker" minis on the line, and provides overall information for higher-level management.

About three man-weeks were required to flowchart the logic and set up all the tables and variables that would be required for the application. We then began actually coding the applications programs. These programs consisted of an executive for timing and response to operator commands; x, y and z drivers; a wind driver; start and stop detects; high-speed and low-speed wind checks (these control the number of winds and determine when it is necessary to slow down the z-axis motor); an auto restart, and an operator request program. Coding and debugging of these programs required about five man weeks.

Hardware implementation was carried out concurrently with our software development. First on the list was quality control at our own factory before shipment. This included subjecting the equipment to environmental tests, hooking up the input-output interfacing, and running a system check. Last step was to load in and test the software. Total effort here was about two man weeks. We then went through a system simulation using Western Electric control equipment for dynamic system tests. For this particular system we did not run a computer simulation model since the equipment to be automated was easily movable and could be hooked up for testing. Finally, there was a total one-time system charge of about $12,000.

Actual installation of the system at Western Electric consumed about two man-weeks, and after several dummy runs, the computers were put to work controlling the winding machines. Our total time spent from the day we started looking at WE's automation needs until the day the first computer was controlling a winding machine was about four months. Total cost: about $45,000. Additional units could be produced at a lower cost since the programming effort would not have to be repeated. Service for the system is on an "on-call" basis, and is about one man day per month. □

Steve Fryer, district manager for General Automation's Los Angeles sales area, is a mechanical engineering graduate of the University of Southern California. Before joining GA, he was a programming analyst and later a sales and applications engineer at General Electric's Process Computer Section in Phoenix, Arizona.

The new PDP-8/e: Its own mother wouldn't know it.

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This powerful *mini/max** computer from Infotronics fills the gap between the minicomputers and the "big boys" but has a modest price tag. And the cost of adding peripherals is less for the *mini/max*, too. Get the full story on realtime executive and the *mini/max* by writing Infotronics, 8500 Cameron Road, Austin, Texas 78753 . . . or calling 512-454-3521.

* Trade Name of Infotronics Corp.

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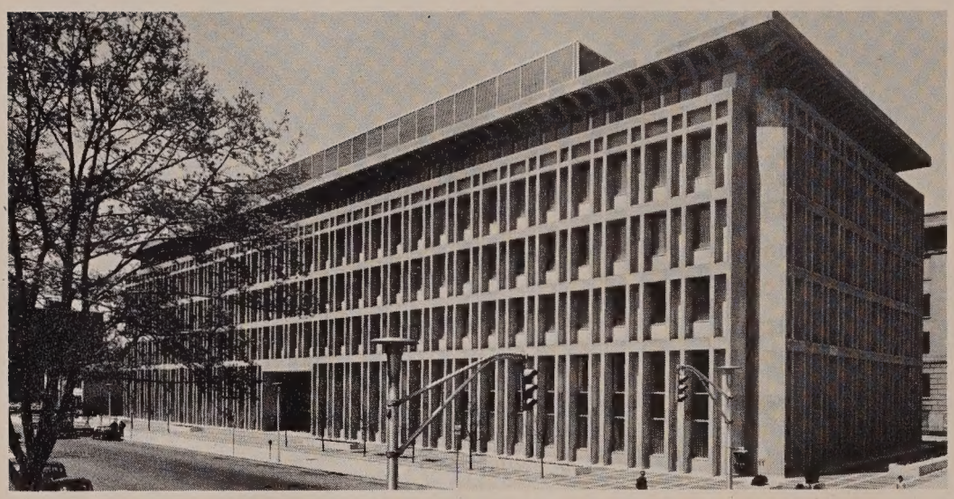
521

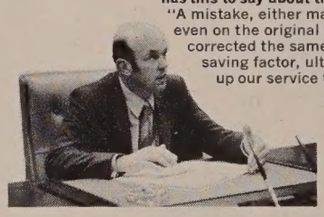
INFORMATION RETRIEVAL NUMBER 11

The incredible reducing machine is here!

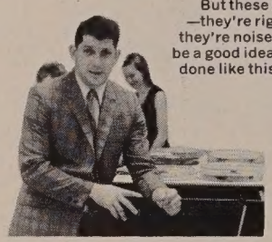


London Life Insurance Company data preparation problems reduced by KEY-EDIT —the incredible reducing machine.

ASK them at London Life, one of Canada's leading insurance companies, how they like KEY-EDIT. They'll tell you that before they gave the Incredible Reducing Machine a trial, their operation was using roughly 23 million key punch cards a year. Next year, KEY-EDIT could reduce that number substantially. This remarkable data preparation system was installed in early April of this year. Ordinary transactions, Automatic Bank Check changes, health claims checks, and other checks that were previously coded on punched cards are now transcribed directly onto tape by KEY-EDIT, and then fed into the big computer in Computer Operations. The reaction to this sixteen keyboard installation has been most favorable for a number of reasons:

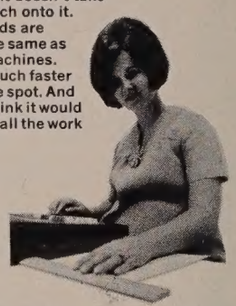


Bill Thomson, Information Systems Executive, has this to say about the KEY-EDIT system: "A mistake, either made by the key-stroker or even on the original card, will be found and corrected the same day. With this time-saving factor, ultimately this will speed up our service to policy owners."



Larry Fazakas, Data Input & Control says: "Every year, we've had a tremendous increase in our workload resulting in more overtime for our keypunchers. We've also had a continual rapid growth in the keypunch area. We hope that with KEY-EDIT we'll slow down this growth rate and reduce the overtime work."

Mrs. Linda Brown says: "I think I'll enjoy working on the system. There's less work involved for everyone and it doesn't take long to catch onto it. The keyboards are pretty much the same as the keypunch machines. But these are so much faster —they're right on the spot. And they're noiseless. I think it would be a good idea to have all the work done like this."



Nancy Foster shows the reel of computer tape that will replace the 32,000 punched cards she is sitting on. KEY-EDIT reduces floor space and costs to a minimum.

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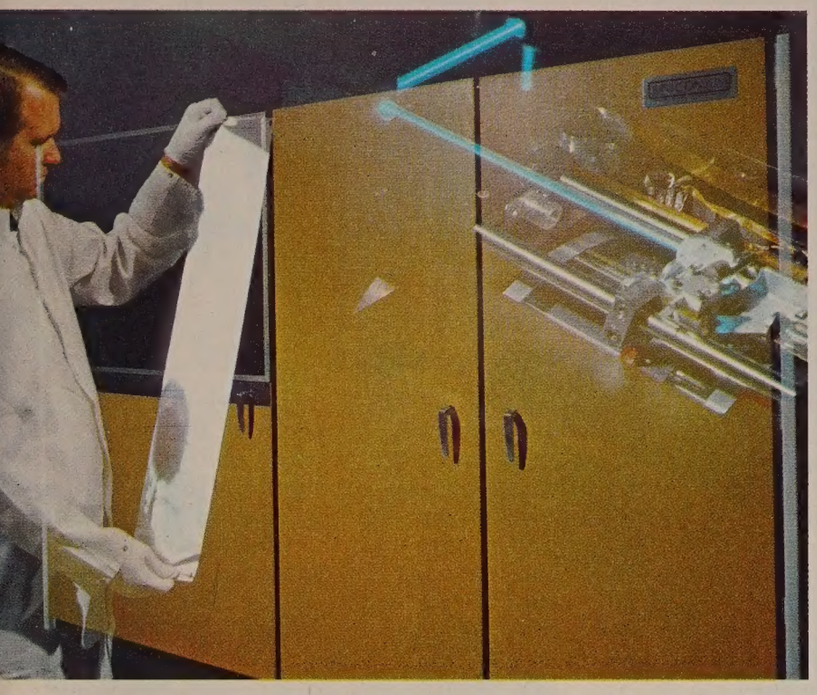


Laser memory offers trillion bit storage

For rapid access to very large data bases, the Unicon laser mass memory can store up to one trillion bits of data and access this data within a maximum of nine seconds. The bits are stored on coated polymer data strips by a laser beam. The system offers read-while-write verification, permanent, nondegrading records, easy updating, and selective retrieval of data based on up to 15 criteria such as: less than, greater than, key word, etc. Two separate and independent data channels are provided, and transfer rate is four megabits per second. For information retrieval, data is tracked by an optical system that will give error rates of less than one part in 10^{10}. The entire system is under the control of a Hewlett-Packard 2116B computer with disk file, magnetic tape unit, and other peripherals. For interface with any selector channel-equipped IBM 360 system or a Burroughs B6500, the system costs $1,000,000 and is delivered within one year. Other systems can be accommodated for a slightly higher price.
Precision Instrument Co., 3170 Porter Dr., Palo Alto, Calif., 94304. (415) 321-5615.

CIRCLE NO. 150

System permits digital analysis of video data

System 800 combines the color display and analysis of video signals with digital storage and processing functions. Working from a black-and-white photograph, picture elements may be added to or subtracted from elements of another picture, scaled, suppressed, correlated or statistically analyzed. The 800 can be used to analyze infrared photographs at a glance by causing subtle shades-of-grey differentiations to be displayed in highly contrasting colors. Other applications include the analysis of gravitational or magnetic fields, light intensity, thermal emission or gamma-ray dose. Programming for the system may be done in Fortran or in machine language. The system can interface with the Varian 620i and with most popular small computer systems. Images may be stored on a peripheral tape handler. Picture transfer between processor and tape takes 18 seconds. At a base price of $63,000, the System 800 can be delivered within four months. A smaller color display system without digital analysis capability is priced at $12,950.
Spatial Data Systems, Inc., 132 Aero Camino, Goleta, Calif., 93017. (805) 968-3594.

CIRCLE NO. 151

Program optimizes schedules for maximum profit

A program called "Tops" provides project managers with an advance measure of the cost impact of alternative decisions, and helps control project costs and schedules. For input, the program uses a cost-versus-elapsed-time function for each individual activity of the project. Tops then produces an optimum schedule for each activity and an interim optimal policy guide for each activity manager. This policy guide provides the managers with advice regarding the best decisions to make in the event of unforeseen problems and analyzes the cost of various alternative solutions. Tops will run on any IBM 360/40 or up with at least 32k of core or on an XDS Sigma 7. It is adaptable to other systems. Priced at $30,000, the system is installed within three months.
Hollander Associates, P.O. Box 2276, Fullerton, Calif., 92633. (714) 879-9000.

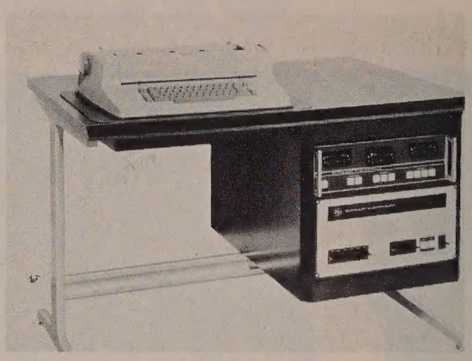
CIRCLE NO. 152

Multiprogramming system for medium-scale users

A multiprogramming system capable of running up to seven jobs concurrently is also capable of handling up to 64 active lines when run in a timesharing environment. The CDC 3170 system has a core memory expandable from 49k to 131k, 24-bit words in 16k increments. The core memory has a cycle time of 1.75 microseconds and offers indexed and indirect addressing, a priority interrupt system and a real time clock. The CDC 3170 is hardware and software compatible with the larger CDC 3300 and 3500 systems. The business data processing version directly executes variable length field instructions. The basic 3174-1 system with processor, 49k of core and two input-output channels and floating point hardware costs $614,755 or leases for $15,765 per month. Delivery is within four months.

Control Data Corp., 8100 34th Ave. So., Minneapolis, Minn. 55420. (612) 888-5555.

CIRCLE NO. 250



Programmable terminal aids remote job entry

Because the GH-500 is a free-standing programmable computer, it can become an integral working unit in a communication network, conserving central computer time and improving throughput. With the remote job entry terminal, the user can detect and correct errors at the source prior to transmission. The system includes 4k, 8-bit words of core, CPU, line printer, card reader, and communications interface. The price is $39,625; delivery is three months.

GH Computers, Inc., 280 S. Beverly Dr., Beverly Hills, Calif. 90212. (213) 278-0882.

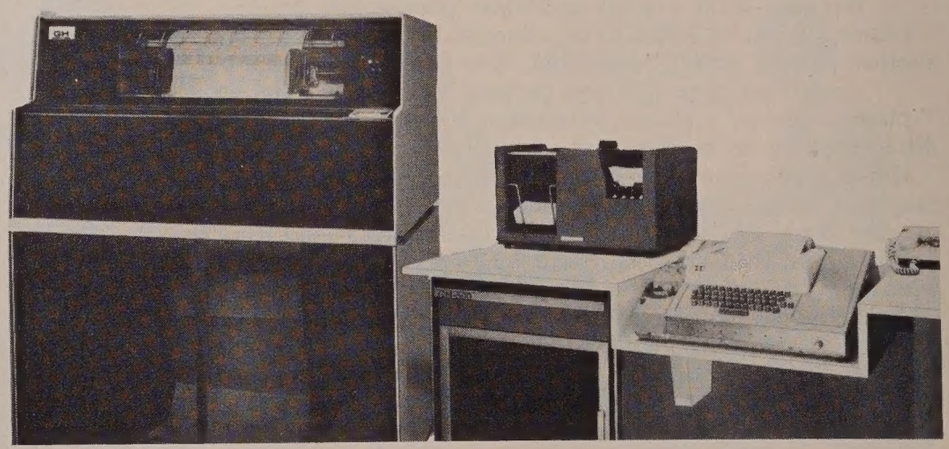
CIRCLE NO. 252

Inexpensive display system for data entry, retrieval

Designed for data entry and retrieval use with data bases, the System IV/70 is a plug-to-plug replacement for the IBM 2260 terminal system. The computer memory has a cycle time of 1.9 microsec. Memory size ranges from six to 96k bytes and word size is 24 bits. Foreground video display control package includes 2848/2260 simulator and software compatible with OS/DOS (BTAM and QTAM). A system including 32 video terminals, a 24k-byte computer, a disk drive, printer, and interface costs $62,400 with delivery in January of 1971.

Four Phase Systems, Inc., 10420 N. Tantau, Cupertino, Calif., 95014. (408) 255-0900.

CIRCLE NO. 251



Office computer edits, corrects, formats data

As a business office computing system, Model 133 can handle payroll, inventory control, accounts receivable, general ledger and management analysis reporting. Using an IBM I/O Selectric typewriter, the operator types the data, which is simultaneously captured on cassette magnetic tape. Each cassette can store 180,000 characters. The Model 133 can turn out personalized letters with full edit, correction and format control. When combined with a Model 150 digital plotter, the system can create statistical distribution analysis, economic charting, comparative financial analysis and product performance charts. When equipped with a communications interface, the system can be time-shared by other terminals. As a multiplexer or concentrator, the unit can handle up to 75 information lines. The Model 133 can also serve as a remote data collection terminal, receiving and transmitting at rates up to 9600 bps. The system is expandable to 32k bytes (8 bit). Price of the 4k system is $22,500. Delivery is within two months.

Eldorado Electrodata Corp., 601 Chalomar Rd., Concord, Calif. 94520. (415) 686-4200.

CIRCLE NO. 253

COURIER ANNOUNCES EXECUTERM II SERIES

A new series of 80-column terminals

Courier further expands the capabilities of the Executerm Terminal line for the time sharing computer user and the IBM 360 user. Executerm Terminals provide fast, flexible computer communications for the widest number of applications, with unparalleled compatibility.

Now, the Courier *Executerm II series* adds 80-character line capability, with up to 24 lines, with *all* the features that have made the Executerm 1, 60 and 65 the *performance oriented* terminals for use in systems of any size...or for use as a single station.

Executerm II is Teletype compatible. Executerm II/60 and II/65 are IBM 360 software compatible...all with 80-character line capability. Printer options are also available.

Whatever your applications...IBM 360 or *any* mini, there is an Executerm communications oriented terminal to give you speed, accuracy and optimum computer usage time, at low cost. Write for detailed literature.

ONE STATION OR A HUNDRED...COURIER MAKES IT WORK!

Courier Terminal Systems, Inc.

2202 East University Drive • Phoenix, Arizona 85034 • (602) 258-7271
Nationwide installation and service by RCA Service Co.

INFORMATION RETRIEVAL NUMBER 13

Multi-media terminal works on- and off-line

Offered as a $500-per-month alternative to the IBM 2770, the Model 340 batch terminal combines card reader, 132-column printer, keyboard/crt display and magnetic tape cassette input-output. Users can lease the terminal with communication adaptors which emulate the IBM 2770, the ASR 33 Teletype or the IBM 1050 terminal. Also, users can upgrade the terminal from ASR 33 or 1050 codes, procedures and line speeds to 2770 codes and procedures at 1,200 baud without teleprocessing system hardware or software changes. The terminal operates with dial-up or private lines and may be configurated for off-line entry. Delivery is 90 days.

Sycor, Inc., 100 Phoenix Dr., Ann Arbor, Mich. 48104. (313) 971-0900.

CIRCLE NO. 110

I/O mini controllers simplify interfacing

The Models GA-1413 and 1414 generalized input and output buffers provide parallel data communications between the company's processors and equipment using TTL-compatible logic circuitry. The units handle input or output data buffering, data buffer flagging, strobing, line driving and card addressing.

Price: $650; delivery is immediate.

General Automation, Inc., 706 West Katella Ave., Orange, Calif. 92667. (714) 835-4804.

CIRCLE NO. 111

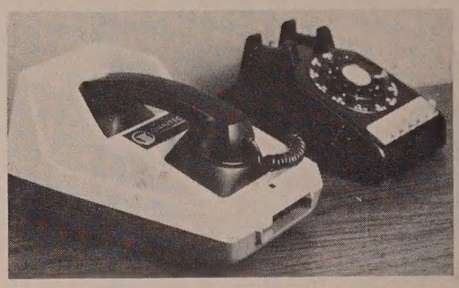
Computer entry system goes on- and off-line

Designed for on-line computer entry, the A-M Series 6000 system provides data transfer without any tape-reel handling. The system consists of a small electronic memory and control unit which is timeshared by up to six keyboard data entry and display stations. Data entered simultaneously from these multiple keyboards is stored within the memory and control unit; groups of records can be recalled for verification by any operator. Electronic keyboards closely resemble those of the conventional card punches. Data entered or called out for verification is displayed in large, illuminated letters and numerals at each keyboard station.

Prices range from $15,000-40,000; delivery is one month.

Addressograph Multigraph Corp., 1200 Babbitt Rd., Cleveland, Ohio 44117. (216) 731-8000.

CIRCLE NO. 112



450-baud coupler offers —50 dBm sensitivity

The Model 701B telephone coupler operates at data rates of up to 450 baud with a sensitivity of −50 dBm. Standard features include dual TTY and EIA RS232 interfaces, full- or half-duplex operation and acoustic or hard-wire coupling. All electronic circuitry and the cushions, switches and connectors mount on a single printed circuit board, which can be easily removed from the case for servicing. The coupler is available off-the-shelf at a price of under $300.

Omnitec Corp., 903 N. Second St., Phoenix, Ariz. 85004. (602) 258-8246.

CIRCLE NO. 113

Key-to-tape unit with read-after-write check

Stand-alone key-to-tape data station offers a read-after-write check, selective non-verification and an English display. The modular Libra 1 unit takes up the same space as a standard key-punch machine. Options include a record counter and listing accumulator.

Prices start at $8,000; delivery in six months.

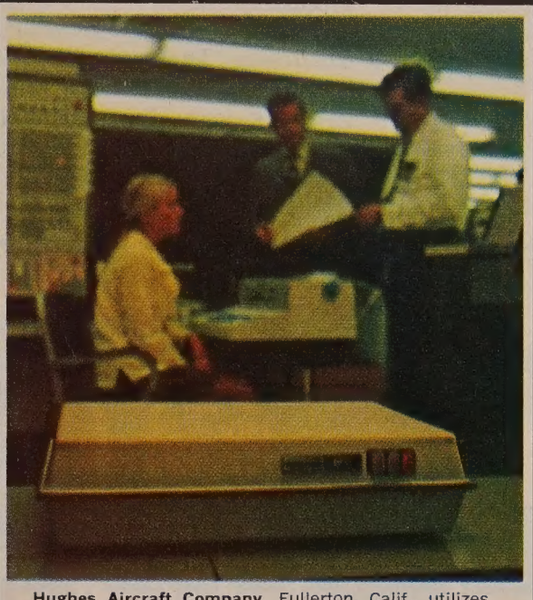
International Data Sciences, Inc., 100 Nashua Street, Providence, R. I. 02904. (401) 274-5100.

CIRCLE NO. 114

Now...a data set without wires

optran has eliminated the need for wires in local data communication. This new transceiver/data set uses proven infrared technology in an innovative new application: point-to-point digital transmission at any data rate up to 250,000 bps. Replacing your present data sets with Optrans will eliminate the high cost and limitations of dedicated lines.

optran has overcome the obstacles to distribution network flexibility. Data can now be communicated directly over freeways, railroad tracks, boundaries between different telephone exchanges or any other surface barrier. Optran is completely portable and easily installed, and data rates are readily changeable in the field. So Optran facilitates flexibility in network configuration and terminal usage.



Hughes Aircraft Company, Fullerton, Calif., utilizes an IBM 360/65 (with a 2701 Data Adapter Unit) for the coordination of process control. Engineering staff inputs circuit parameters to the main data banks at this end. Operating at 9600 bps, the OPTRAN transmission link affords high-speed, error-free direct communication of data to Manufacturing's remote installation for development of process control specifications.

One-half mile away, Manufacturing's Interdata Model 4 uses data from the remote 360/65 to generate punched tapes for control of automatic wiring machines. Soon, this data will be used for direct control of circuit board drills, wire processors, etc. Without OPTRAN, on-line operation would be less efficient, because retransmissions due to burst errors on common carrier facilities would result in lower throughput. During OPTRAN's first two months of operation, only one bit error has been recorded.

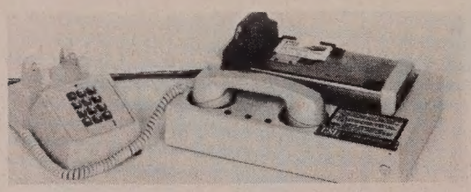
optran has made high-speed remote terminals financially feasible. Optran is an ideal data link for putting remote job entry terminals on-line. Or interfacing computer to computer. Or providing on-line service to a combination of terminals using CTC's unique multiplex capability. And Optran pays its own low purchase price in data communication cost savings.

Low-Cost Local Data Distribution

For information about your specific Optran application, contact

COMPUTER TRANSMISSION CORPORATION
1508 COTNER AVENUE · LOS ANGELES, CALIFORNIA 90025 · (213) 477-5020

INFORMATION RETRIEVAL NUMBER 14



Terminal converts phones into credit centers

For as little as $7.00 per month, the Compliatone terminal converts standard touch-tone telephone equipment into a "full compliance" credit authorization center. Operating over the dial-up telephone network, the terminal assures that a sales clerk complies fully with prescribed credit-approval procedures. The store clerk dials the computer, places the handset in the terminal's acoustic coupler and indexes the account number on the touch-tone pad. The cpu accesses the customer's file and returns an audio response which activates one of three light indicators. Delivery is 90 days.

Credit Systems, Inc., Route 309 and Advance Lane, Colmar, Pa. 18915. (225) 822-3371.

CIRCLE NO. 115

CRT display boasts 68-character repertoire

Priced at $1,280 in 100-unit quantities, the Series 400 crt display offers a repertoire of 68 dot-matrix characters available in a variety of formats up to 1,536 characters per page. Available in single- or multi-station configurations, the Series 400 offers editing, page formatting and fixed-message display in a self-contained package with detachable keyboard. Delivery is 90 days.

TEC, Inc., 6700 S. Washington Ave., Eden Prairie, Minn. 55343. (612) 941-1100.

CIRCLE NO. 116

OCR reader gives small user a break

Intended for the small-scale OCR user, the Orbit 1 can read at 108 characters per second and up to 130 cards per minute. Designed to read a single line with up to 70 numeric characters, the OCR document reader features an optional head which permits reading of characters and ordinary pencil marks from the same document in the same pass. The unit comes with an automatic feed and two stackers and reads documents ranging in size from four inches to 7.5-inch horizontal, three inch to four inch vertical and from 0.004 inches to 0.0075 inches thick. Basic unit costs $21,800 and includes a document handler, camera, video processing electronics, recognition logic, and document handler control electronics. The unit will be available in the fourth quarter of 1970.

Orbital Systems, Inc., Fellowship and Church Rds., Moorestown, N. J. 08057. (609) 234-1700.

CIRCLE NO. 117

The most expensive word in business is: maybe

It is a virus of uncertainty, a fever of indecision...Maybe.

When business conditions are good the malady lies dormant. But when the economy falters, when competition sharpens, the crippling effect of the situation becomes apparent.

One source of the problem is a failure to communicate—not just in words, but in the motivating information exchanges which are the touchstone of business decision-making. Another is the failure of a manager to extract the total benefit from his company's computer-based information system.

This new course from Kepner-Tregoe communicates a process for resolution:

LOGIX® provides a rational process for bridging the gap between operating managers and the highly technical administrative personnel responsible for Management Information Systems. The manager—across practically every aspect of the corporate spectrum—is the crucial informational interface between problem and solution. Yet he often feels alienated from his computer team. LOGIX gives the manager a cogent appreciation of his alliance with the computing system and a clear process for fulfilling his leadership role.

LOGIX, designed to help business fulfill its prime directive...And *no maybe* about it.

For more information about *LOGIX* and other contemporary courses for today's business, contact: Marketing Department, Kepner-Tregoe, Inc., Princeton, N.J. 08540, Tel: (609) 921-2806

KEPNER TREGOE® Kepner-Tregoe, Inc., Princeton, New Jersey

INFORMATION RETRIEVAL NUMBER 29

Aids management in forecasting, planning

A series of computer programs assist management in forecasting, planning and decision-making. The programs will run on the XDS 940 or any IBM 360 timesharing system. The "Adsim" program ($10,000) is used for risk and venture analysis. It is an interactive language for strategic decision-making and financial planning which can be used to write financial analysis programs in such areas as pricing and new products. The "Adfin" program ($6,000) allows the user to select an activity and develop a cash flow analysis and projections to see the financial effects of various plans on the company. "Adtree" ($5,000) uses decision tree and risk analysis to evaluate the expected impacts of alternative courses of action. "Adlin" is an interactive generalized linear program designed for the easy solution of standard linear programming problems. "Adfit" ($3,000) allows time series analysis of data and permits the study of relationships between two sets of data for predictive purposes. The prices include the object program and training and installation assistance. Delivery is within two months.
Applied Decisions Systems, Inc., 1300 Soldiers Field Rd., Boston, Mass. 02135. (617) 783-4100.

CIRCLE NO. 223

Cross assembler features speed and convenience

A cross assembler written in Standard Fortran offers speed, convenience, and host machine independence. "Bias" is presently available for the PDP-11 and will assemble code under level G Fortran IV on most systems having at least 100k of core. Bias features include automatic selection and freedom to use forward references in all argument expressions.
Price: $1,000. Delivery: one month. Versions for other systems are forthcoming.
Compata, Inc., 18345 Ventura Blvd., Tarzana, Calif. 91356. (213) 881-4000.

CIRCLE NO. 224

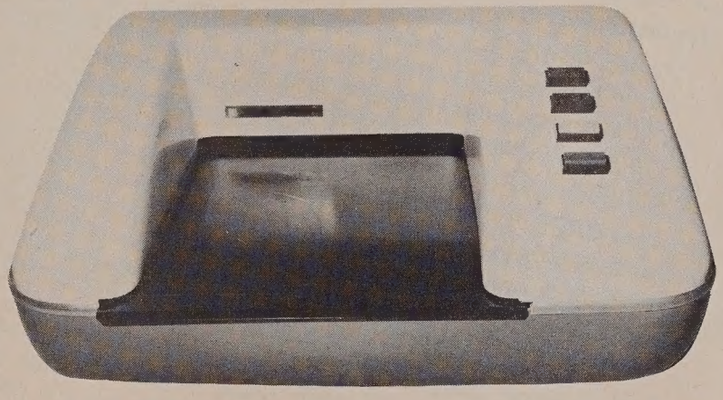
Package speeds computer-to-computer data transmission

A software package is designed for high speed data transmission between a central and one or more remotely located computers. The Bocs (bisynchronous oriented communications system) package will support leased lines with transmission speeds of 1,200 to 240,000 bits-per-second for transmission of sequential data files. Written in assembler language, Bocs will also help level work loads among several large computer facilities. Bocs is compatible with any multiprogramming environment and will run on any IBM 360/25 or up with at least 32k core. The program also generates daily and monthly reports on transmission time and circuit efficiency. The program including installation is priced at $9,650 and installation is within one month.
G T & E Data Service, 5422 Bay Center Dr., Tampa, Fla., 33609. (813) 877-8021.

CIRCLE NO. 225

A NEW DIMENSION IN SOURCE DATA AUTOMATION

dataflow optical page reader



The age old problems of manual data preparation such as key punching and verifying have long been accepted as a necessary evil to input man-generated data into an EDP System. The advent of Optical Character Readers (OCR) has opened new horizons in this area; however, the associated prices for OCR equipment has made its availability prohibitive for all but the most affluent of users. The Dataflow Optical Reading System now brings OCR capabilities down to price range compatible with key punching and verifying.

DATATYPE CORPORATION
1050N.W.163rd Drive, Miami, Fla. 33169 (305) 625-2489

INFORMATION RETRIEVAL NUMBER 19

Automated service documents programs

Automated documentation services are now available for all Cobol, PL/I, Fortran, BAL, Autocoder/SPS and RPG programs. Documentation includes source listing, data-name, tag-name and paragraph-name cross-references, functional equate tables, tables of modified instructions and format and coding logic diagnostics. All are cross-referenced to a detailed flowchart of the program logic. Accurate documentation in standard format is easily maintained and permits auditing of all program operations. Also, it provides the detail written records you need to treat programming costs as capital expenditures under IRS regulations. Cost is proportionate to program size resulting in a charge of about $15 for an average program. Delivery is within two weeks.
Software Documentation Corp., 3550 West Peterson Ave., Chicago, Ill. 60645. (312) 478-8404.
CIRCLE NO. 130

CASE

CASE takes the guesswork out of making sound computer system decisions—*accurate* decisions which may involve even the most complex aspects of multiprogramming, real-time or time-sharing systems.

CASE (Computer Aided System Evaluation) is a *proven* simulation system which will predict for any application the interaction of virtually any combination of computer hardware, software, data base and user programs.

Use CASE for—
- **Overall System Design**
- **Configuration Management**
- **Equipment Selection**
- **Installation Audits**

The use of CASE is the least costly way to make system decisions; it is available under lease, license or service plans. We can train you to use it or we will provide highly skilled and experienced analysts to assist you in your simulation efforts. CASE will also interface with our X-RAY™ Computer Performance Measurement System.

For complete details, contact:

APPLIED SYSTEMS
Division of Computer Learning and Systems Corporation
5530 Wisconsin Avenue, Chevy Chase, Maryland 20015
(301) 652-9220

INFORMATION RETRIEVAL NUMBER 20

Analyzer measures computer performance

To provide users with a complete picture of computer system performance, X-RAY measurement system reports on configuration utilization, system software overhead, application program efficiency and data base element activity. Once you know the interaction of these components of computer performance, you can make system improvements empirically through various techniques including equipment configuration balancing, job scheduling and procedure modifications. The analyzer is priced at approximately $50,000.
Computer Learning and Systems Corp., 5530 Wisconsin Ave., Chevy Chase, Md. 20015. (301) 652-9220.
CIRCLE NO. 131

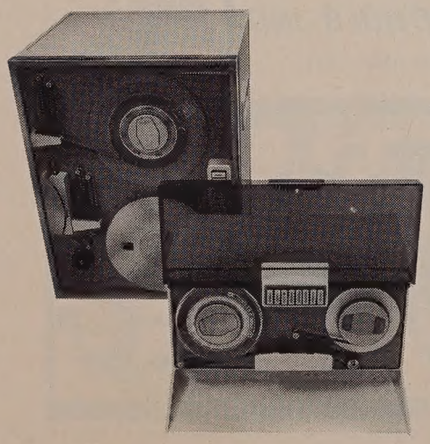
Language translators for any computer group

Able to run on any selected group of computer systems, this service will provide translators which can handle existing common languages such as Fortran, Cobol, and PL/I, or user-specified procedure or problem-oriented languages. This means that the client can develop programs for a current computer system knowing that they will also operate on any future system he may select. The system-independent translators are also useful to those with more than one type of computer system. The service is available nationwide and is priced by contract.
Information Resources, Inc., 331 Alberta Dr., Amherst, N.Y. 14226. (716) 835-3037.
CIRCLE NO. 132

Time-sharing network links major cities

A computer-time-sharing service called the National System allows organizations with offices and plants across the country to share programs and data in a single, central computer. Subscribers to the service can tie into the computer through existing SBC leased telephone lines simply by dialing the nearest network access telephone number. The service has a monthly minimum of $100. Connect time costs $13.80 per hour.
The Service Bureau Corp., 1350 Ave. of the Americas, New York, N. Y. 10019. (212) 262-5000.
CIRCLE NO. 133

Required reading!



This new brochure documents more than 20 important features that have made the Mod 7 and Mod 10 the *modern standard* for low-cost magnetic tape systems. The Mod 7 and 10 give you plug-to-plug compatibility with most controllers, optimum tape interchangeability with IBM systems, high reliability and easy maintenance. Compare, features and value. You'll see why more and more computer, keytape and terminal OEMs are doing their "required reading" and writing on Wang Mod 7 and Mod 10 tape handlers. Call or write for your copy of this new brochure. It's *Required Reading.*

WANG COMPUTER PRODUCTS, INC.
2000 Stoner Ave., Los Angeles, Calif. 90025 (213) 478-7727

INFORMATION RETRIEVAL NUMBER 21

EDP exam explained

The Certificate in Data Processing (CDP) examination program sponsored by the DPMA is the subject of a 16-mm color sound film entitled "The Key." The 25-minute film is designed to stimulate interest in the examination program by explaining its purposes and objectives. Points covered in the film include the essential facts a person interested in taking the exam needs to know about it, such as eligibility requirements, and where and when it is held. Prints of the film can be obtained from DPMA division vice presidents free of charge for viewing by local DPMA chapters and other interested groups, corporations and other EDP-oriented associations.
Data Processing Management Assoc., 505 Busse Highway, Park Ridge, Ill. 60068. (312) 825-8124.
CIRCLE NO. 101

DEC software: Some 700 applications programs for the DEC PDP-10 computer (in addition to standard DEC-supported software) are contained in the PDP-10 Application Software Bulletin. Listing includes software available through the DEC user group (DECUS), or through sale or trade. Also listed are programs under development.
Digital Equipment Corp.
146 Main St.
Maynard, Mass. 01754.
CIRCLE NO. 102

Paperwork: "Reduce the Paper Mountain to Management Size" is a three-ounce (24¢ with wrapper first-class-mail charge), 42 ¾-inch (when extended fully) foldout brochure describing Datagraphix mag-tape/microfilm systems. Well presented, illustrated. Specs on the systems included.
Stromberg Datagraphix, Inc.
Box 2449, San Diego, Calif. 92112
CIRCLE NO. 103

GE-100 banking systems: the latest additions to the General Electric line of bank-information systems are detailed in a four-page brochure. Included are sections on the GE-105 Remote Banking System and the GE-115 Bank Information System. Both systems are designed to process MICR-encoded documents. Specify GEA-9281.
General Electric Information Systems, Bldg. 6-207, Schenectady, N.Y. 12305.
CIRCLE NO. 104

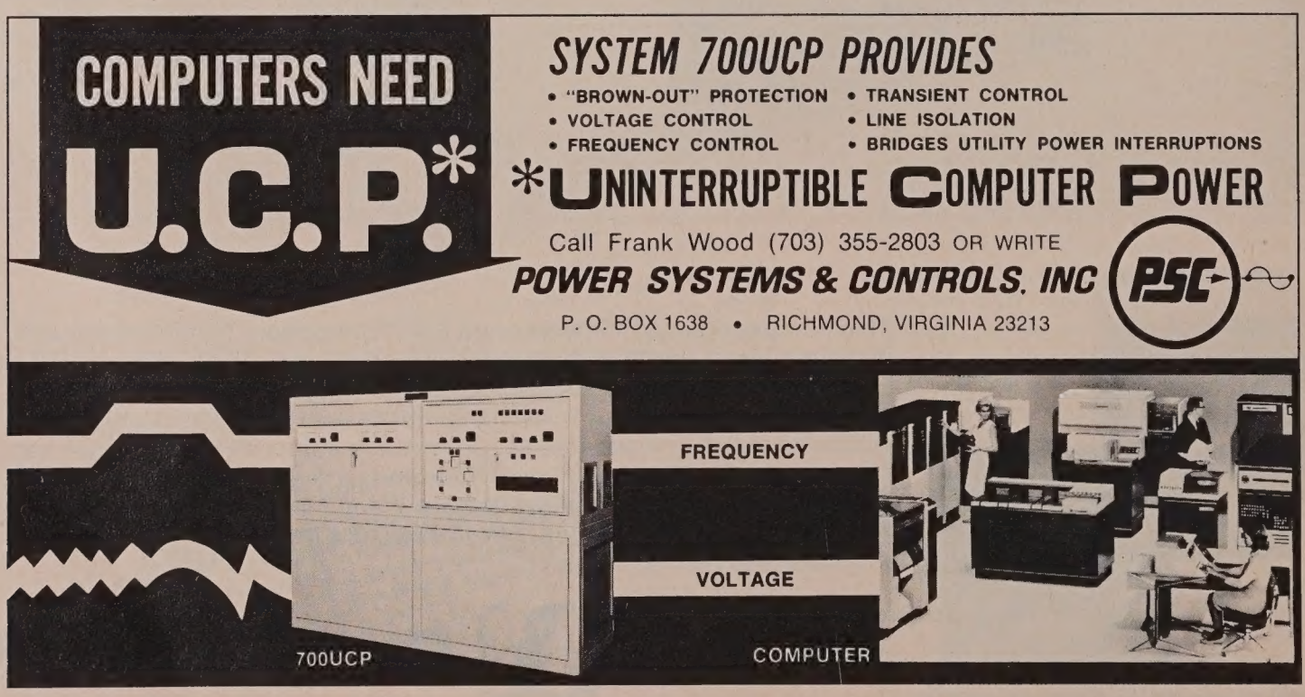
From the folks who brought you the 707: Boeing's computer services are described in a series of one-page sheets stapled together. Included are conversational terminal services, RJE, computer time sales, computer facilities management and application programming.
Boeing, Computer Services Division
P. O. #3707
Seattle, Washington 98124.
CIRCLE NO. 105

Accessory catalog: 2,000 varied items including fire-protection files for computer tape and punched cards, furniture for the computer room, and magnetic and paper tape are listed in a catalog which is billed as containing "The World's Largest Selection of Data Processing Supplies and Accessories."
Edward Ochman Systems, Box 141
Fairfield, Conn. 06430.
CIRCLE NO. 106

Calculators: The series 100 calculators for scientific, engineering and statistical calculations are described in a four-color, eight-page brochure.
Wang Laboratories, Inc.
836 North Street
Tewksbury, Mass. 01876.
CIRCLE NO. 107

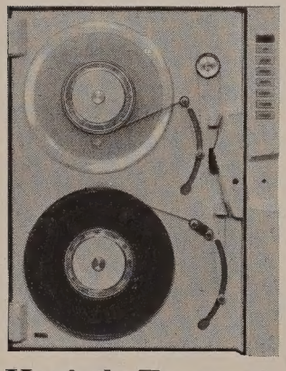
How to get the most out of your computer staff: 20-page report of that title contains information on designing an employee-development plan, and how to train programmers, analysts and managers.
Advanced Management Sciences
Box 56, Lynnfield, Mass. 01940
CIRCLE NO. 108

DC1000: six-page booklet describes Burroughs' processors for controlling peripheral gear at remote locations.
Burroughs Corp.
2nd Ave. at Burroughs,
Detroit, Mich. 48232.
CIRCLE NO. 109



INFORMATION RETRIEVAL NUMBER 22

PEC's just filled the vacuum with a 45ips no vacuum transport. It does everything any other transport can do. For $3150.



Here's the Transport.

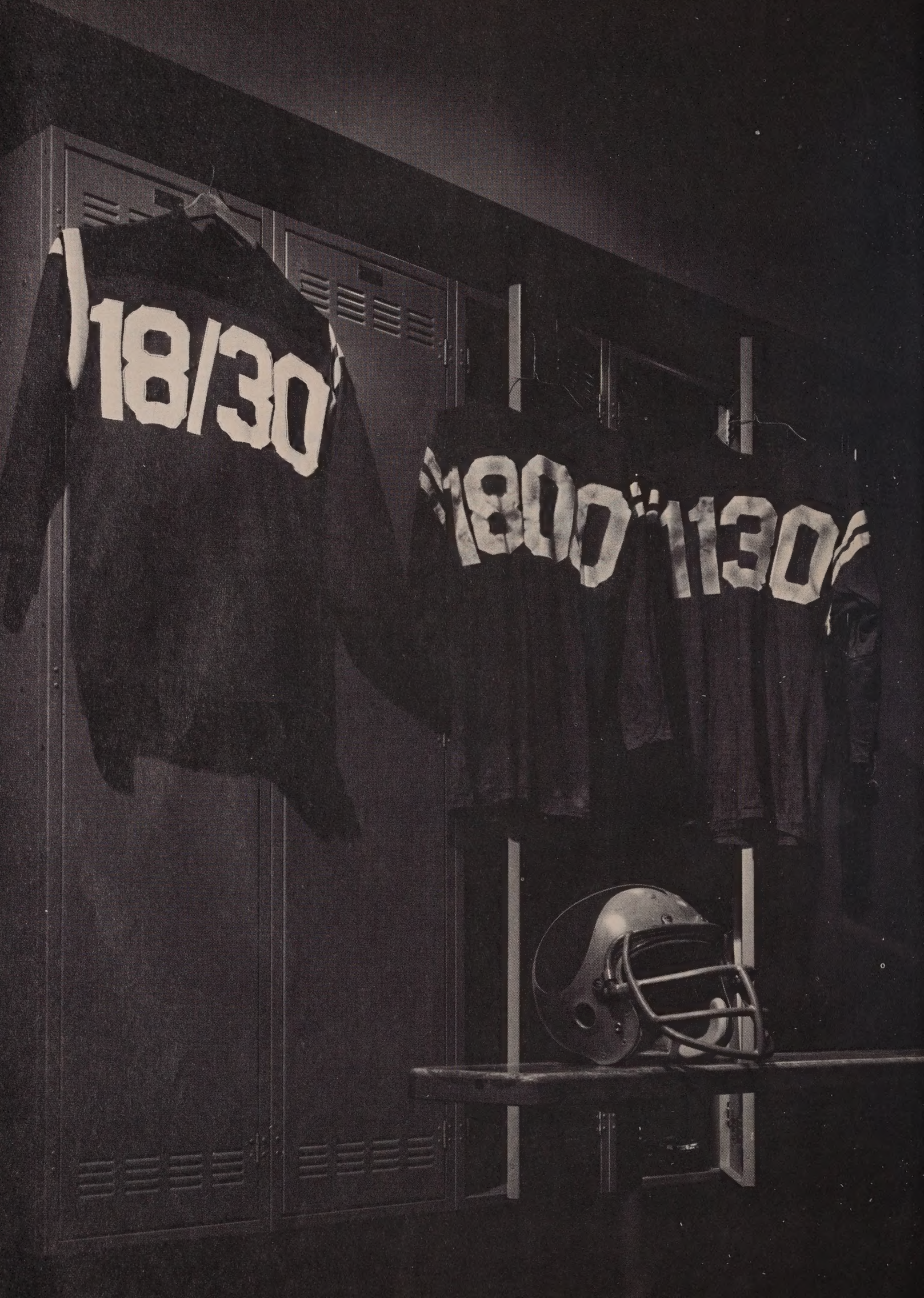
Here's the Proof.

Here's a complete new line of low cost, 45ips transports that get up to speed with no velocity transients, no overshoot, and no ringing. And a price tag of $3150 in quantities of 100 for read-after-write. Available in read/write at $2930 in the same quantities, and at similar low prices in 72 new models of read only for off-line applications such as COM. With exclusive PEC data recovery features, this new 45ips, 10½" reel 6000 series comes in 7- and 9-track, 800cpi NRZI. Also available in the new 9-track, 1600cpi phase-encoded USASII and IBM compatible formats. Get the full story on this 45ips breakthrough. Write Peripheral Equipment Corporation, 9600 Irondale Avenue, Chatsworth, California 91311. (213) 882-0030.

PEC

SALES OFFICES: Los Angeles (213) 882-0030 • Orange County (714) 546-4836 • Chicago (312) 696-2460 • Boston (617) 899-6230 • New York (203) 966-3453 • London Reading 582115

INFORMATION RETRIEVAL NUMBER 23


18/30
1800 1130

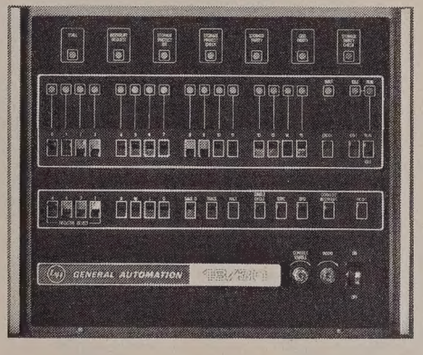
Time to retire the old numbers?

Now . . . The System 18/30 is a super star among automation computer systems. General Automation has added big muscle to the 18/30 in terms of two new software systems — TSS and DMS. Look at this new line up.

TSS is a real time programming system that **replaces** the IBM TSX. It offers program supervision, time keeping, interrupt processing and peripheral control for improved operation of data acquisition and process control applications. TSS is in operation now . . . in key customer locations . . . using software developed for 1800 systems.

DMS . . . replacing the IBM DM2 . . . is a disk-oriented batch processing system using card or key board entry permitting operator monitoring of primary system functions and generating higher throughput levels with greater flexibility and adaptability. Present DM2 1130 packages will run under DMS.

And here's a quick replay of other packages offered. DBOS . . . A user-oriented disk based operating system for batch JOB processing and the compatible RTX software system for real time multi-programming.



And as a bonus . . . all software is available as off the shelf packages.

This new 18/30 Software power makes it "no contest" in system competition — the 18/30 provides a performance/price ratio 20 to 100 times over the old players. If you use the 18/30 to replace your "retiring" system, your software investment is protected. For new installations, the education process with the System 18/30 is minimal.

Now . . . before you invest in any system see our complete line-up.

GENERAL AUTOMATION, INC.

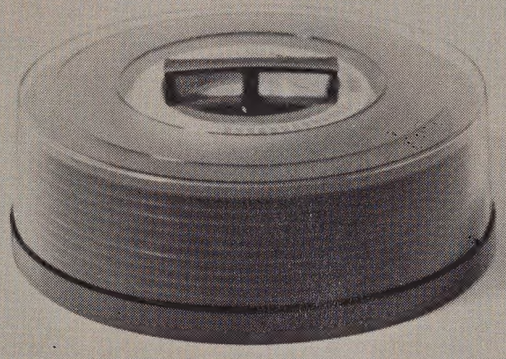
1402 East Chestnut Ave., Santa Ana, California 92701
Tel: (714) 835-4804 • TWX — (910) 595-1780

CALIFORNIA — Los Altos, (415) 941-5966, Santa Ana, (714) 835-4804 • CONNECTICUT — Stamford, (203) 325-3883 • GEORGIA — Atlanta, (404) 261-6203
ILLINOIS — Des Plaines, (California G.A. Corp.) (312) 298-4650 • MARYLAND — Silver Spring, (301) 587-7090 • MICHIGAN — Detroit, (313) 965-9090
OHIO — Cleveland, (216) 351-2275 • PENNSYLVANIA — King of Prussia, (215) 265-6525 • TEXAS — Dallas, (214) 358-0271, Houston, (713) 774-8716
BELGIUM — Brussels, 13 78 03 • ENGLAND — Esher, 65764 • GERMANY — Aachen, 02405-4444, Wiesbaden, 06121-83073

INFORMATION RETRIEVAL NUMBER 30

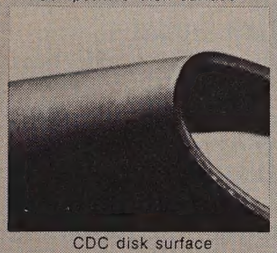
The salesman who says all disk packs are alike

may not want to talk about the differences.



You can't blame him. Unless you want to be selfish. Unless you're concerned about the "typical" problems that go along with typical performance.

Competitive disk surface



CDC disk surface

Unretouched photos of bent disks shows a difference you get with CDC

If you're going to be that one-way, you'd be better off with a CDC man.

He *wants* to talk about problems, because he has a way to solve them. He'll tell you what makes a CDC disk pack different. And makes it the highest performance, most reliable, longest lasting pack available anywhere.

You'll find the discussion brief and interesting. Then he'll tell you the cost. You'll find that surprising.

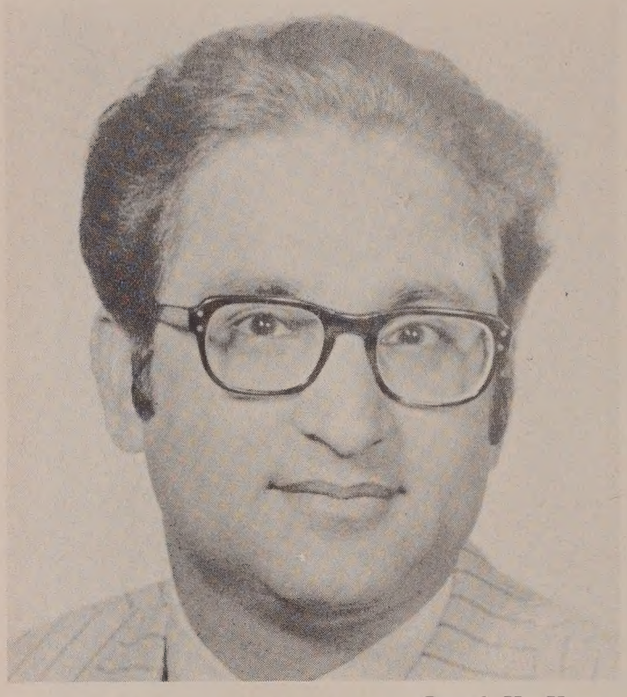
To find out the difference, get our free booklet. Circle the number below, or phone our main office on our "hot line." Call, collect, (612) 884-8195.

CONTROL DATA CORPORATION

Business Products Group
Dept. 314
Control Data Corporation
P.O. Box 1980
Minneapolis, Minn. 55111

INFORMATION RETRIEVAL NUMBER 5

Self-help education and training can help stem the data processing people crisis



Gopal K. Kapur
Assistant professor
San Jose State College
San Jose, Calif.

The "education gap" in the data processing field seems to be growing rather than diminishing. As computers go more and more places, systems become steadily more complex, and languages and programming methods proliferate, there is a heavy demand for sharp people who are up-to-date with current equipment and methods. What is disturbing is that users, the ones primarily affected, often do little more than complain about the situation.

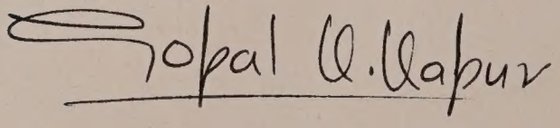
With some initiative and imagination, data processing people can greatly increase educational opportunities for themselves, the people in their own group, their associates in nearby installations, and other management people in their own company. Here are some specific suggestions.

Today there are lots of seminars, three-day short courses, and so on, where people travel from city to city, pay $375 fees, and get information which may or may not be helpful for their particular learning needs. Why shouldn't data processing specialists organize lots more free seminars on a local level? In most areas, people in the data processing community know each other. Why can't they arrange to get together at someone's house and have three or four people talk about areas in which they have particular knowledge? These people might prepare for three or four months to give two-hour discussions on subjects like "converting from second to third generation programs" or "how to analyze and cut down on costs."

In small groups there would be a chance to get to the core of subjects and problems with valuable practical knowledge being exchanged. There would be no expensive dinners. Maybe coffee, or tea, but no drinks (it would be a working session not a social hour). These local, informal meetings might easily be arranged through the chapters of the ACM, DPMA, AMA, or other societies.

Within a data processing organization, why not have selected individuals prepare presentations for in-house discussion sessions? Aside from teaching other members of the organization about these topics, the people who are giving the instruction will greatly benefit from having to structure their ideas for teaching others who may be neophytes. Enough time should be given so that a good presentation can be prepared, and the manager should check the results before going ahead with group instruction.

As for other managers within the company, the data processing people should occasionally be routing good computer articles from the Harvard Business Review, Computer Decisions, Fortune, or other publications that have non-technical material. Also, why not have short tours of the facility with different data processing people telling about what they do and how the equipment works? But these must be aimed at fundamentals. Once I was giving a talk to a group of top managers and after things became relaxed and we were chatting about the systems, one of them asked how the different machines were connected together! We in data processing forget about things like the false flooring hiding all those cables between parts of the system! So don't start with things like dynamic allocation of core—even computer experts have trouble understanding that!



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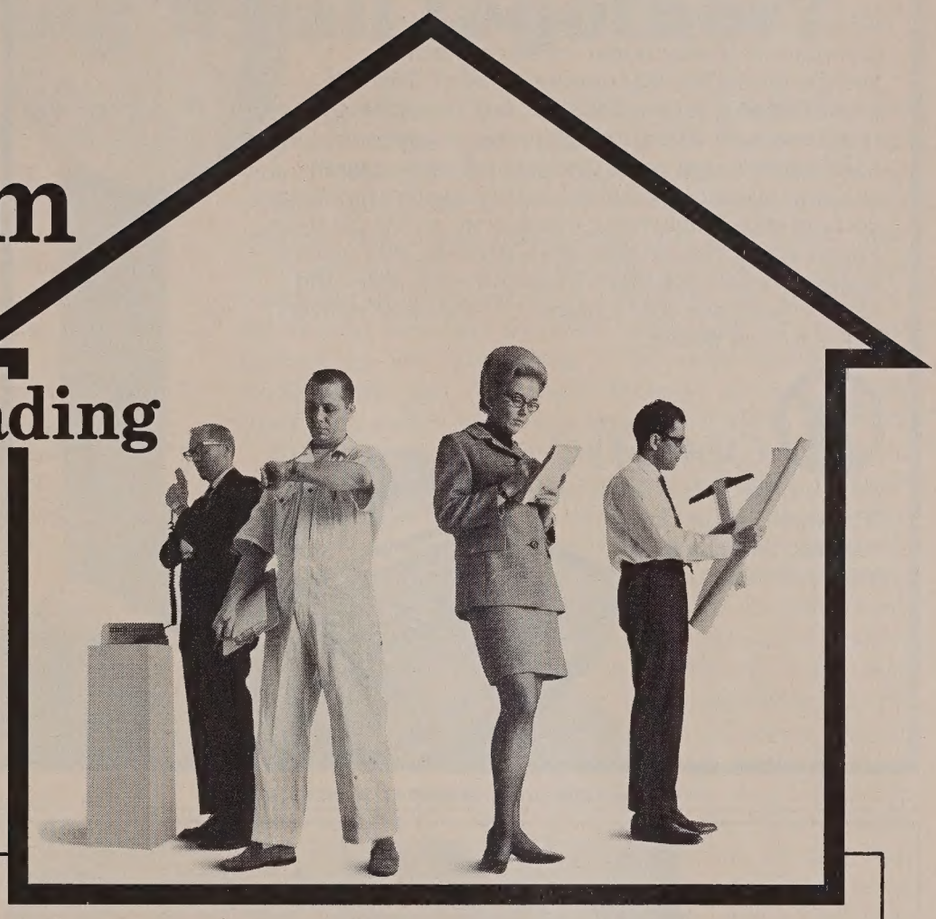

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- *To provide a marketplace for new development in hardware, software and services within both the data processing and information industries.*
- *To give a platform for the presentation of the user's viewpoint.*

Will an American Computer Society bring us all together?

You probably know your Congressmen because their activities are, no doubt, well covered by your local paper and tv station. But who speaks up for computer people? I'll bet that a quick survey of your colleagues will produce almost as many answers as you have colleagues. According to this year's SJCC program, the American Federation of Information Processing Societies (AFIPS), which sponsors the JCC's, also "acts as national spokesman for the information processing community in matters dealing with or affected by computing, data processing and related sciences." Well now, that's pretty much all-encompassing isn't it? But when did you last hear of AFIPS making a presentation to a Congressional committee, or answering one of those newspaper horror stories about the computer that became fouled up?

However, despite its claim to represent 100,000 computer professionals, only professional societies can be members of AFIPS. Currently, those members are the Association for Computing machinery (ACM), The Computer Group of the Institute of Electrical and Electronics Engineers (IEEE), Simulation Councils, Inc., (SCI) and the American Society for Information Science (ASIS) plus seven affiliates, presumably lesser bodies than the four big boys. You may be a member of one of the four principal societies of AFIPS. When did you last hear one of them busily representing you? They don't get involved in Congressional affairs (too political), they don't get involved in employer/employee relations (not professional), they don't get involved in presenting a public image for their members (too much like public relations) and so on.

Maybe the time has come for a real society that will look after the interests of people in the computer community without regard for either academic distinctions or so-called professional considerations. How about, say, an American Computer Society open to anyone who wants to join. No academic qualifications needed, no years of experience required. Naturally only those people who are interested in data processing would be likely to join, but others, such as legislators and local and Federal government officials, might also want to join. Such a catholic membership could provide excellent communication between those actively involved with computers and those only marginally involved. The British have had a nationwide society for some years now and their British Computer Society has a membership that is larger than that of the ACM—and that in a country that has only one tenth of the computers installed in the U.S.

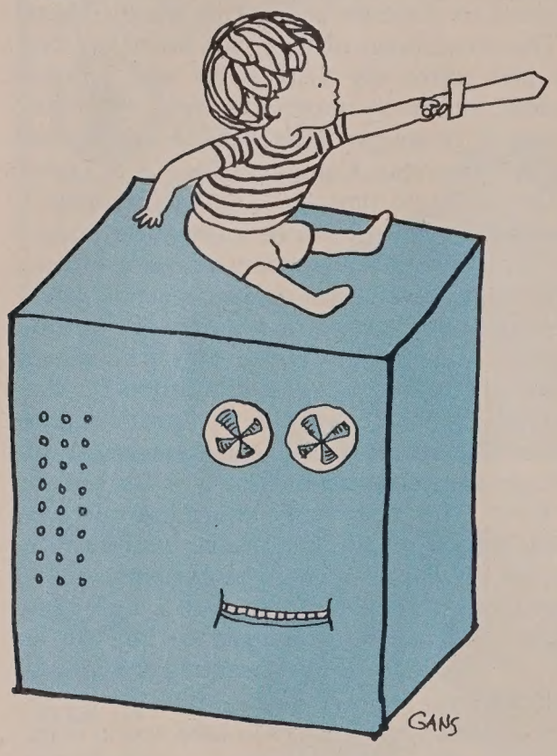
Getting an American Computer Society going will require cash—a lot of it. The only organization that currently is profitable is one without members, and one in which those who provide funds, namely members of its constituent societies and those members of the community who support and attend conferences, have no direct electoral say—AFIPS. The board of directors of AFIPS is composed of representatives elected by the councils of the various members societies and not by the members themselves. The proceedings of the AFIPS board are not made public and conversely there is no way for the computing public to directly impress its views on AFIPS.

Unfortunately it is almost impossible to expect the move toward an American Computer Society to come from within AFIPS. At no time has AFIPS taken definitive steps towards amalgamating its component societies. In fact the factionalism appears to be growing. The Computer Group of the IEEE has recently been considering establishing itself as a professional society outside the IEEE. Although this is probably not looked upon with much favor by the IEEE establishment, the Computer Group expects to become "a society within IEEE" whatever that is. Recently, an Association of Computer Programmers and Analysts was formed in New York City. The new association has already started its own branch on the internecine warfare that characterizes many of the related professional computer societies. Isn't it about time we took a look outside these petty differences and began to aim for a society that will take care of representing the entire computer community?

One way of persuading legislators to take action is by bombarding them with letters, telegrams, personal contacts, etc., that encourage a particular line of action. I'd like to suggest that we begin to approach people in the computing community who might be active in forming a new American Computer Society either by devoting time or by sponsoring loans to get the new society off the ground. My list would include: Sam Wyly, UCC; Dr. Herbert Grosch, NBS; Robert Bemer, GE; Max Palevsky, XDS; Charles P. Lecht, Advanced Computer Techniques; Dr. E. S. Savas, City of New York; Daniel McCracken; Paul Williams, Boothe Computer Corp.; Phillipe Yaconnelli, Katun Corp.; Dick Brandon, Brandon Applied Systems; Dr. Louis Robinson, IBM; Martin Goetz, Applied Data Research.

By the time you read this Perspective, all the people on my list will have received a copy of this column and a personal letter encouraging them to action. How about forming your own list and writing for yourself? COMPUTER DECISIONS will gladly provide reprints of this Perspective, if needed, and forward letters. *J.N.B.*

How will the computer be used to help design the coming generation?



There is a unique aspect to this time in human history. The "tools" that bind our civilization into a unified system are for the first time beginning to change in the period of a decade or less. Changes will be even more rapid in the future. This is having serious effects on the ability of our social institutions to adapt to the changes.

By "tools" we refer to something similar to Marshall McLuhan's "media." For example, in Roman days, roads were a significant development for human interchange. Money for trading, clocks and watches for making appointments, and the printing press were all "tools" with profound effects. The succession of vehicle transportation (chariots, carriages, sailing ships, steam engines for ships and railroads, automobiles, airplanes) and communications media (drum, telegraph, radio and television) have all brought great changes to civilization.

As time passed, each of these tools moved from idea to widespread use in a shorter period. In past eras there was time for social structures to adjust so that the new tools could be integrated into their fabric. Today the time is much shorter, and tomorrow, it will be even less.

A central problem is that people are not used to changing their habits, the ways they conduct their daily lives, their loyalties and interests, in a short period of time.

For example, how well is the government adjusting to such things as controlling data banks, coping with environmental pollution, or stemming urban decay? How well is labor adapting to automation and management to the computer?

The answer to all these is the same . . . poorly.

Although the tools are changing more and more quickly, we are not significantly changing the way in which we teach our children to adjust to these ever-more rapid changes. Much unrest among young people all over the world today is undoubtedly because of their awareness of the flaws in our current social structures coupled with the realization that they are not being properly prepared to make the necessary adjustments.

We have hardly begun to deal with the computer, today's chief offender in disrupting society. Yet its potential for the future is so far only dimly perceived.

One hopeful prospect for the computer, one that has hardly been touched, is for education. Properly used it might help young people to become adept at exploratory, creative activity. This is the kind of learning that pre-school children do naturally, but that is trained out of them by conventional education with its strictures against making mistakes, "silly" ideas, or non-curricular activity. Such creative methods may be the only way for the next generation to cope with rapid changes.

So far the concentration of large computer manufacturers, and of government funding, has been on computer-aided instruction based on the methods of conventional education. Today there are a few individuals and groups exploring the possibilities of tying the computer into new modes of education. We urge much greater support for this work, preferably outside large manufacturing firms whose major concern is sales.

Through the medium of education we "design" the next generation for a world to come. It now seems clear that if tomorrow's adults are not highly adaptable, creative and adjustable people, they're not going to make it! Why do we waste so much money and effort in the wrong directions? *R.C.H.*

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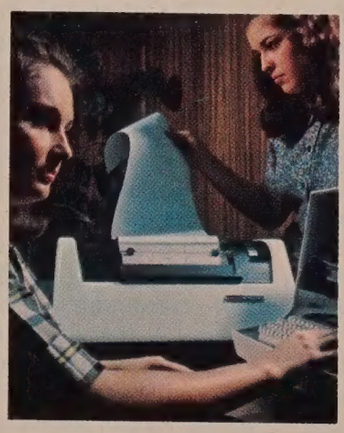

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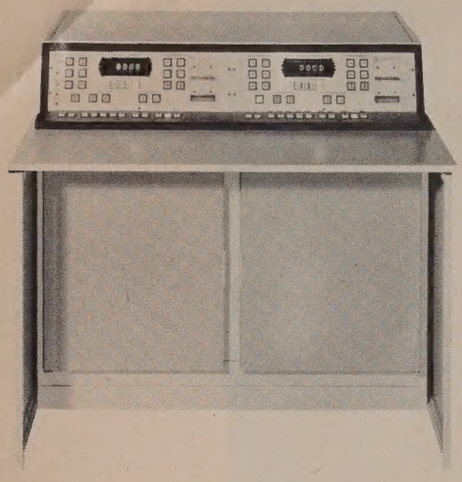

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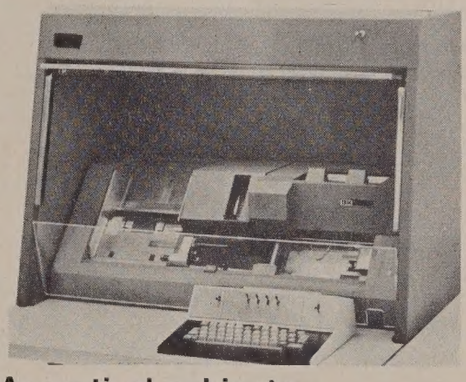


Acoustical cabinets for edp equipment

More than 40 different models of acoustical cabinets are offered to cut edp equipment noise by as much as 50 per cent. Floor and desk cabinets for IBM key punch machines, communications terminals, magnetic tape typewriters, teletypewriters, Friden Flexowriters and Xerox machines are available. The price for the key punch machine cabinet pictured above is about $200 and delivery is within two weeks.
Edward Ochman Systems, Box 141, Fairfield, Conn. 06430.
(203) 259-1927.

CIRCLE NO. 222

INPUT UNDERGROUND ATTACKED AS ADVERTISING GIMMICK.

Dear Underground:

Okay. I'm on to you. The Input Underground is nothing but an advertising gimmick to call attention to Recognition Equipment's new product line.

Why can't you guys run straight ads like everybody else?

J.C.B.
Des Moines, Iowa

Dear J.C.B.:

The Input Underground contacted Recognition Equipment in regard to your letter. They sent us the following straight ad:

INPUT 80:
THE EXPANDABLE READING SYSTEM

Somebody finally developed a comprehensive page reading system that can be customized to the job and expanded to handle a growing workload.

Somebody finally developed INPUT 80.

The new OCR system, designed and developed by Recognition Equipment Incorporated, is three to twelve times faster than the company's previous page reader. It's also more flexible and more versatile.

INPUT 80 can process a wide variety of forms and read a large number of type fonts as well as handprinting, carbon copy and mark sense data.

The system can be used for many applications in many different industries.

In the banking field, INPUT 80 can save considerable time by replacing keypunch and tedious data conversion techniques now used to process installment loans, demand deposits, and savings account transactions.

Insurance companies can cut data processing costs critically by using INPUT 80 to process daily reports, claims and premium billing. Service bureaus serving independent insurance agencies can put INPUT 80 to work on a whole range of insurance records management jobs.

There are also applications for INPUT 80 in state government. The Department of Motor Vehicles can use the system to process drivers license applications. The Human Resources Development Agency can use INPUT 80 to process wage and salary reports, applications for disability and unemployment insurance, and other field-prepared forms. The State Controllers office has two major needs for INPUT 80, payroll and claims.

And, the Board of Education in any major city will find life a lot easier if they process student records with INPUT 80.

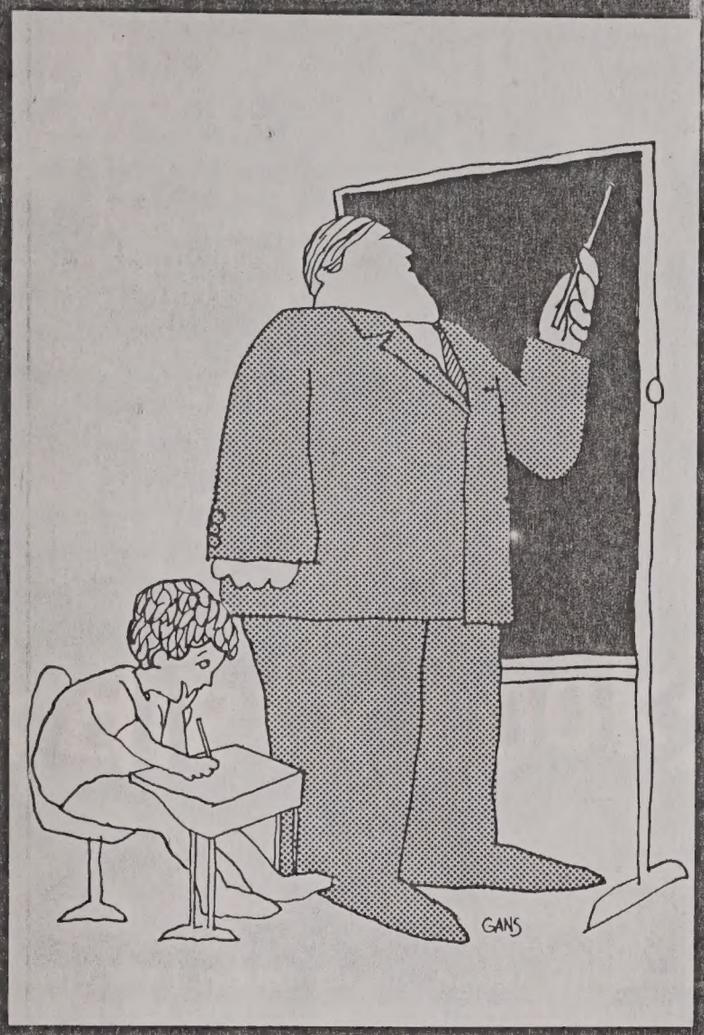
For complete information on INPUT 80 or other Recognition Equipment Systems, write to us care of the Input Underground, P.O. Box 5274, Dallas, Texas 75222.

How's that J.C.B.?

It's not too late to join the Input Underground. Just send us your name and address and we'll send you a membership card and button.

PUBLISHED AS A PUBLIC SERVICE BY RECOGNITION EQUIPMENT INCORPORATED.

INFORMATION RETRIEVAL NUMBER 17



Did you find school dismal and dreary? Did it turn you off? Here the author proposes safe and legal ways to turn kids on.

by Theodor H. Nelson
The Nelson Organization
New York

Some think the educational system is basically all right, and more resources would get it working again. Schools would do things the same way, except more so, and things would get better.

In that case the obvious question would be, how can computers help? How can computers usefully supplement and extend the traditional and accepted forms of teaching? This is the question to which present-day efforts in "computer-assisted instruction" — called CAI — seem to respond.

But such an approach is of no possible interest to the new generation of critics of our school system — people like John Holt (*Why Children Fail*), Jonathan Kozol (*Death at an Early Age*) and James Herndon (*The Way It Spozed To Be*). More

NO MORE TEACHE

and more, such people are severely questioning the general framework and structure of the way we teach.

These writers describe particularly ghastly examples of our schooling conditions. But such horror stories aside, we are coming to recognize that schools as we know them appear designed at every level to sabotage the supposed goals of education. A child arrives at school bright and early in his life. By drabness we deprive him of interests. By fixed curriculum and sequence we rob him of his orientation, initiative and motivation, and by testing and scoring we subvert his natural intelligence.

Schools as we know them all run on the same principles: iron all subjects flat and then proceed, in groups, at a forced march across the flattened plain. Material is dumped on the students and their responses calibrated; their interaction and involvement with the material is not encouraged nor taken into consideration, but their dutifulness of response is carefully monitored.

While an exact arrangement of intended motivations for the student is preset within the system, they do not usually take effect according to the ideal. It is not that students are *un*motivated, but motivated *askew*. Rather than seek to achieve in the way they are supposed to, students turn to churlishness, surliness, or intellectual sheepishness. A general human motivation is god-given at the beginning and warped or destroyed by the educational process as we know it; thus we internalize at last that most fundamental of grownup goals: just to get through another day.

Because of this procedure our very notion of human ability has suffered. Adult mentality is

cauterized, and we call it "normal." Most people's minds are mostly turned off most of the time. We know virtually nothing of human abilities except as they have been pickled and boxed in schools; we need to ignore all that and start fresh. To want students to be "normal" is criminal, when we are all so far below our potential. Buckminster Fuller, in *I Seem To Be A Verb*, says we are all born geniuses; Sylvia Ashton-Warner tells us in *Teacher* of her success with this premise, and of the brilliance and creative potential she was able to find in all her schoolchildren.

Curricula themselves destructively arrange the study situation. By walls between artificially segregated "studies" and "separate topics" we forbid the pursuit of interest and kill motivation.

In ordinary schooling, the victim cannot orient himself to the current topic except by understand-

ERS' DIRTY LOOKS

ing the official angle of approach and presentation. Though tie-ins to previous interests and knowledge are usually the best way to get an initial sense of a thing, there is only time to consider the officially presented tie-ins. (Neither is there time to answer questions, except briefly and rarely well — and usually in a way that promotes "order" by discouraging "extraneous" tie-ins from coming up.)

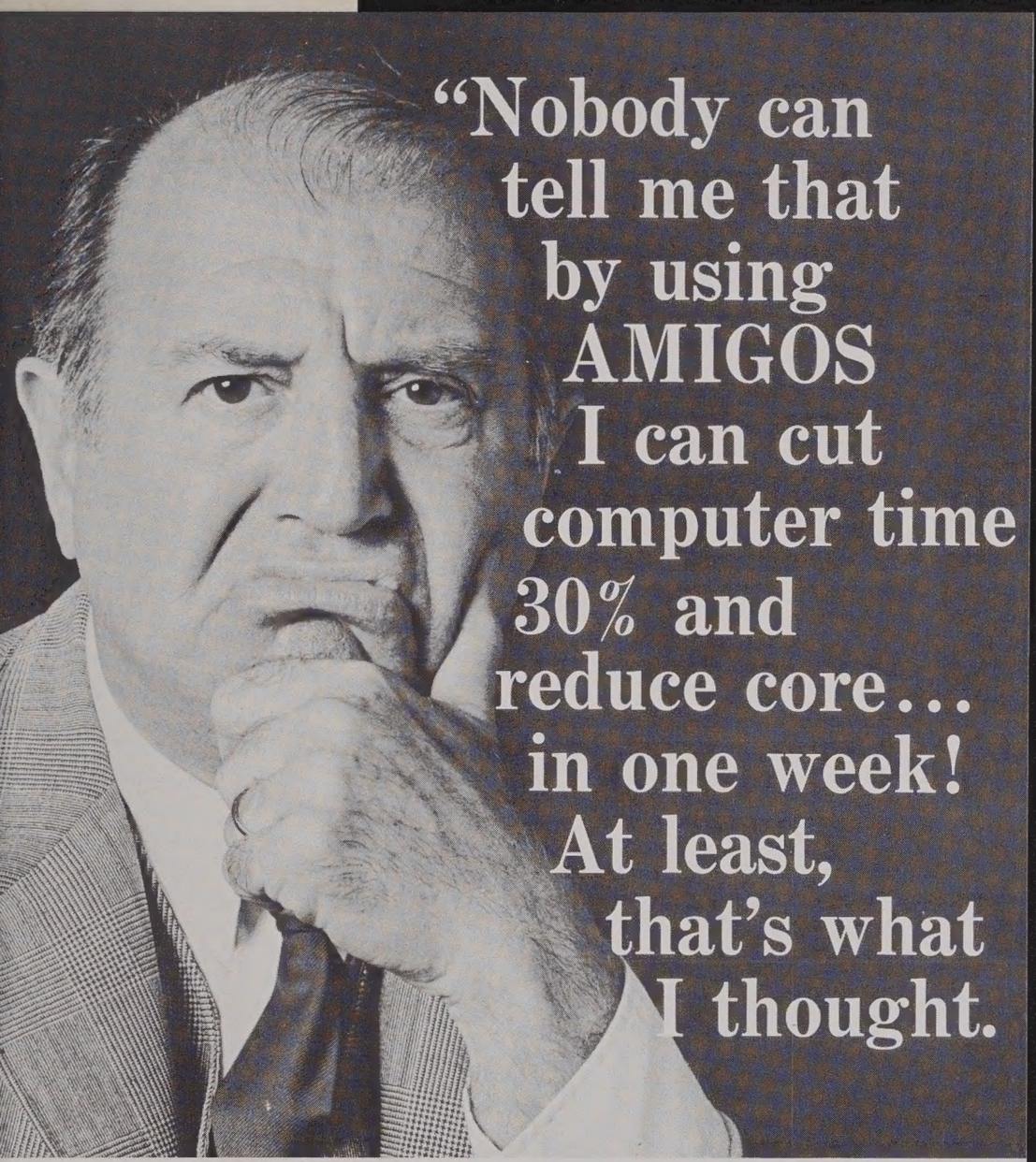
The unnecessary division and walling of subjects, sequencing and kibbling of material lead people to expect simplifications, to feel that naming a thing is understanding it, to fear complex wholes; to believe creativity means recombination, the parsing of old relations, rather than synthesis.

Like political boundaries, curriculum boundaries arise from noticeable features of a continuum and become progressively more fortified. As behind political borders, social unification occurs within them, so that wholly dissimilar practitioners who share a name come to think they do the same thing. And because they talk mainly to each other, they forget how near is the other side of the border.

Because of the fiction of "subjects," great concern and consideration has always gone into calculating the "correct" teaching sequence for each "subject." In recent years radical new teaching sequences have been introduced for teaching various subjects, including mathematics and physics. But such efforts appear to have been misinformed by the idea of supplanting the "wrong" teaching sequence with the "right" teaching sequence, one which is "validated." Similarly, we have gone from a time when the instructional sequence was a balance between tradition and the lowest common denominator of each subject, to a time when teachers may pick "flexible optimized strategies" from text-

© Walt Disney Productions

If the computer is a universal control system, let's give kids universes to control.

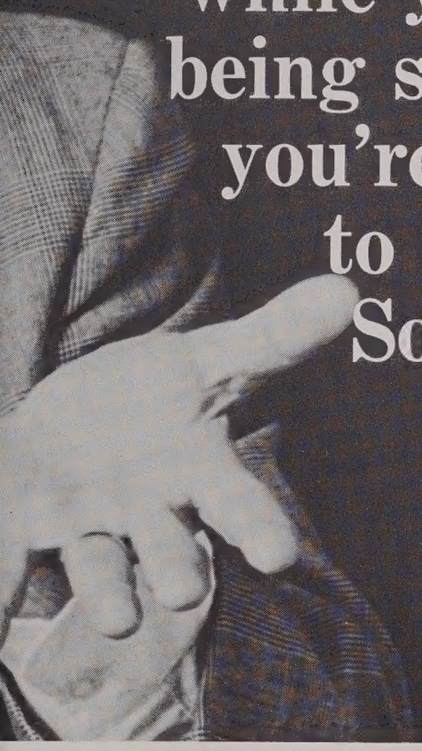


"Nobody can tell me that by using AMIGOS I can cut computer time 30% and reduce core... in one week! At least, that's what I thought.

Pardon me if I consider myself an expert on computer systems, and especially the IBM 360. I've been in the computer game for years, used the 360 ever since it was introduced. I use them every day — at least my people do. When the man from Comress told me I could cut time and costs, I just couldn't believe it. Especially when other good men had tried, and failed. But then he told me about a new file accessing technique — AMIGOS — that replaces my computer manufacturer's ISAM — my biggest single time-consumer!

The man from Comress told me AMIGOS is easy to install, avoids major file conversion, and involves only minimum cost and personnel time. He said it's simple to replace ISAM. All I had to do was to change my COBOL programs to use AMIGOS linkages and convert my files to AMIGOS formats . . . and Comress supplied programs to do it automatically! And if I had used BAL, he was prepared to help me as well. I've heard these stories before. But I decided I had nothing to lose. If it was good, I was ready to take advantage of a good thing, Maybe I could show *him* something.

"But when you're under more and more pressure to get more and more work done—at lower cost —while your budget is being squeezed... maybe you're more inclined to take a chance. So I did.



He said I could eliminate ISAM from my system. But I'd be crazy to cut loose from the old program to try out a new one. So he said I could keep ISAM if I wanted to, for conversion purposes, or any other reasons (I didn't tell him what my other reason was!) He said I could use AMIGOS for my time consuming programs and ISAM for the others, and everything would work fine. So I told him to go ahead and show me.

It wasn't until afterward that I learned that the Comress design team members who developed AMIGOS each had worked on IBM 360 software development for five years. So they knew their system and software.

He told me AMIGOS is a tighter program, more efficiently written, and uses true third generation design techniques. It eliminates the major weaknesses of the indexed sequential accessing methods written five years ago.

"Sure I told the man from Comress to go ahead and show me. But I told him if he didn't meet his minimum commitments for AMIGOS...he's had it!

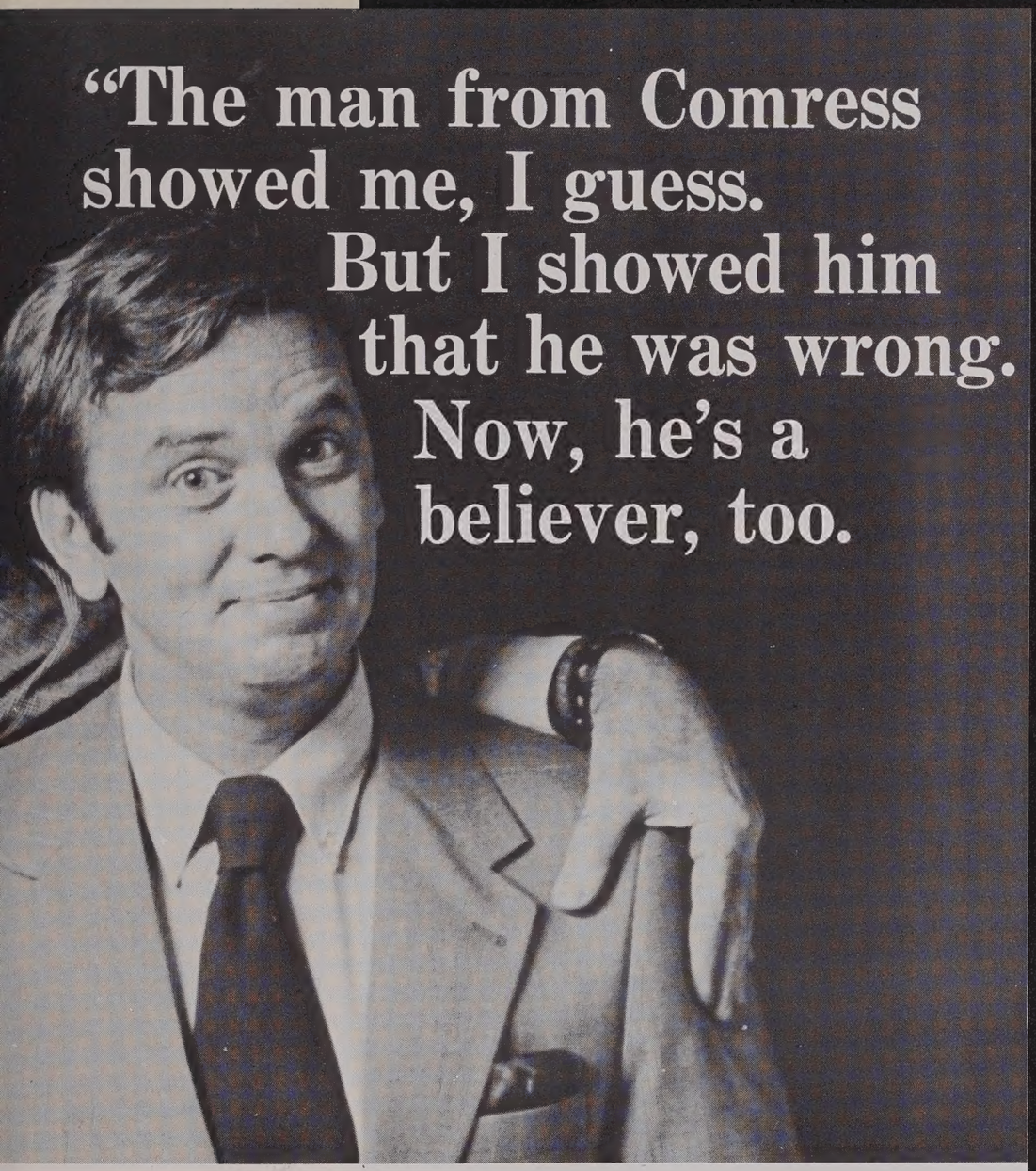
It wasn't just the improvements in performance that AMIGOS tried to prove to me. The man from Comress talked new features too. COBOL programs where you can intermix random and sequential processing of the same file with AMIGOS without frequent openings and closings.

Its files are really multi-purpose. Or secondary allocation so you don't have to reserve lots of extra disc space if you guess wrong. Or generic searches by COBOL programs — something you could never do before. I listened. And I really started hoping he could deliver.

In spite of what I showed him, he still goes around telling people that they'll get only 30% less processing time with AMIGOS — while I'm getting 50% less!

I really took that guy to the cleaners. Sure, he told me about one guy who cut running time 50%, when all he promised me was at least 30% less running time. I'm getting so many savings in so many ways—on the big programs. I'm saving a lot more than 40,000 bytes he said was tops in savings. Disc space is much less than the 80% of previous space I needed.

"The man from Comress showed me, I guess. But I showed him that he was wrong. Now, he's a believer, too.



See, I'm the kind of manager who is less interested in what a salesman claims than in the way I can show him how I capitalize on the product he sells me. Of course, most 360 users might not have the experience and know-how that I have — well, that my staff has. Maybe that's the reason Comress is so conservative in making claims. They realize these advantages over ISAM can result in varying benefits for each user on his own system. So they just tell you the minimum they will guarantee.

*AMIGOS vs. ISAM

Programs with heavy disc I/O run in 50% less time.

- one set of control blocks for both random and sequential processing of file.
- record blocking for overflow same as prime data.
- precise indexing for faster searches.
- "skip mode" record storage reducing rotational delay.

Core storage is 1/2 to 1/3 less, from 10,000 to 40,000 bytes. Large programs +40,000 bytes.

- ISAM (random and sequential) requires 16,000 bytes plus 3,000 bytes per file.
- AMIGOS (random and sequential) requires only 11,000 bytes plus 600 bytes per file.

Up to 20% less disc space.

- re-use of disc space after deletion, without reorganizing.

Automatic "on the fly" file reorganization; less frequent: 1/3 time when necessary.

Simpler preparation and operation. 1 JCL card/file vs. as many as 3 for ISAM; fewer JCL parameters.

Your Comress representative is ready to demonstrate how AMIGOS can help you cut costs, improve reliability and system performance . . .

Comress — Boston 617-332-4700	Comress — Chicago 312-298-4180	Comress — Detroit 313-356-7171
Comress Ltd. — London 014-050-085/7	Comress — Los Angeles 213-641-8171	Comress — New York 212-736-7707
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Headquarters Offices
Two Research Court
Rockville, Md. 20850
301-948-8000